Manual No. : M503-E017
Revision : C

Mobile X-ray System
MUX-100D
OPERATION MANUAL

Read this manual carefully for correct product use.

Keep it with the equipment.

Medical Systems Division

SHIMADZU CORPORATION

KYOTO JAPAN

Thank you for purchasing a SHIMADZU medical system. Prior to using this unit, be sure to read these “Safety Instructions” carefully and operate the equipment within its design specifications.

The meanings of the following precaution and prohibition terms used in the operation manual are defined as below:

Safety Instruction Meanings

DANGER	Indicates a direct danger that may cause death or serious injury if it is not avoided.
WARNING	Indicates an indirect or potential danger that may cause death or serious injury if it is not avoided.
CAUTION	Indicates a danger that may cause slight or medium degree of injury, or may cause equipment damage or fire if it is not avoided.
NOTE	Indicates information useful for correct system operation.

Indications for Use

All procedures that use the Mobile DaRt must be prescribed by a physician and treatment determined by qualified personnel (i.e. Radiological Technician).

The MUX100D is not labeled or intended for home use. It is intended to be used in a hospital environment by qualified personnel.

The MUX100D is not shipped as a sterile device, as indicated by labeling.

Original version is approved in English.

Safety Instructions

Both users and professional service engineers should be sure to follow the safety-related instructions given here. To fully understand the safety instructions related to each product, be sure to carefully read each related Operation Manual and/or Installation Manual.

(Items 2. and 3. are intended only for professional service engineers.)

Operating Precautions when Using Electrical Medical Equipment (for Both Safety and the Prevention of Danger)

1. Only qualified radiographic staff should operate the equipment.

2. During installation:
   (1) Do not install the equipment near water supplies or equipment using water.
   (2) Do not install the equipment where extreme atmospheric pressures, temperatures or humidity, drafts, direct sunlight, dust, chlorine or sulfur gas are present.
   (3) During transportation and operation of the equipment, avoid tilting, vibration and strong impacts.
   (4) Do not install the equipment where chemicals or gases are stored.
   (5) Be sure to use only the specified electrical power source with the appropriate frequency, voltage and current (or power consumption).
   (6) Check the condition of the battery's power source (power and polarity) before operating the equipment.
   (7) Properly ground the equipment.

3. Prior to operating the equipment:
   (1) Check the conditions of switch contacts, polarity, dial settings, and meters, and confirm that the equipment performs correctly.
   (2) Confirm that the ground is properly connected.
   (3) Check that all cords, cables, and other wiring are correctly connected.
   (4) Be careful when simultaneously using more than one unit, since it can be dangerous and lead to an incorrect diagnosis.
   (5) Check all external electrical circuits, which are directly connected to a patient.
   (6) Check the condition of the battery's power source.

4. While operating the equipment:
   (1) Do not over-exceed time or the amount of equipment use needed for diagnosis or therapy.
   (2) Observe the equipment and patient continuously for early detection of problems.
   (3) When a problem is detected with the equipment or patient, take proper action to stop the equipment without harming the patient.
   (4) Do not let the equipment touch the patient.

5. After operating the equipment:
   (1) Turn off all switches and return all dials to their original positions in the prescribed order. Then, turn off the main power switch.
   (2) Do not pull the power cable forcibly from the outlet.
   (3) When storing the equipment, pay attention to the following factors:
      (i) Do not install the equipment near water supplies or equipment using water.
      (ii) Do not install the equipment where extreme atmospheric pressures, temperatures or humidity, drafts, direct sunlight, dust, chlorine or sulfur gas are present.
      (iii) During transportation and operation of the equipment, avoid tilting, vibration and strong impacts..
      (iv) Do not install the equipment where chemicals or gases are stored.
   (4) Clean all attachments, cables and contacts, and store them in one place.
   (5) Keep the equipment clean to avoid problems during the next use.

6. When the unit does not operate correctly, do not try to repair it. Place a sign on the unit to indicate that it is out of order and contact a certified repair technician.

7. Do not modify any part of the equipment.

8. Preventive maintenance
   (1) The equipment and its parts should be periodically checked.
   (2) If the equipment has not been operated for an extended period of time, test it prior to actual operation to make sure it works correctly and safety.

9. For other related items, be sure to follow all instructions given in the equipment's operating manual.

WARNING

The responsibility for correct management of use and maintenance of medical equipment lies with the user.
The equipment should not be used by other than a qualified person or under the direct supervision of a qualified person.
Unauthorized repair and inspection of the equipment may be dangerous. All service should be carried out by an authorized Shimadzu Service center.

NEVER MODIFY THE EQUIPMENT!

The Drugs, Cosmetics and Medical Instruments Act of Japan makes it compulsory that a manufacturer should apply and get approval for any modifications to the equipment. Modifications without approval are prohibited.

PERFORM PERIODIC INSPECTION!

Preventive maintenance is required to maintain operational safety and long-term performance of this system.
This manual gives detailed description of occasional and periodic maintenance and inspections that a user should perform.
As to the maintenance and inspections that specially trained specialists must perform, utilize the maintenance agreement offered by your nearest authorized Shimadzu service center.

CAUTION

Federal law restricts this device to sale by or on the order of a physician.
(U.S.A. Federal Regulations require this information.)

GUARANTEE

The guarantee period of this system is one year from the date of purchase. Shimadzu Corporation is not responsible for loss/damage of data and the following failures or damage of the system.

1. Failure/damage of the system caused by improper installation, movement, maintenance, or repair performed by anyone other than Shimadzu and authorized Shimadzu service personnel.
2. Failure/damage to a product of Shimadzu caused by another company's product not delivered by Shimadzu.
3. Failure/damage of the system resulting from maintenance, repair, etc., using spare parts other than genuine parts specified by Shimadzu.
4. Failure/damage of the system resulting from not following notes or operating procedures described in this operation manual.
5. Failure/damage of the system caused by ambient or environmental conditions beyond the recommended service conditions applicable to this system described in this operation manual, such as power source and installation requirements.
6. Failure/damage of the system caused by environmental pollution or any natural disaster such as a fire, earthquake, flooding, or lightning.
7. Failure/damage of the system resulting from installing the system in vehicles, ships, or aircrafts without Shimadzu's consent.
8. Failure/damage of the system resulting from installing or connecting software programs or peripheral devices not specified by Shimadzu.
9. Failure/damage of the system resulting from changing or deleting configuration files (autoexec.bat, config.sys, etc.) of the basic software or DR system files.
10. Failure/damage of the system caused by use of the system in countries not specified by Shimadzu.
11. Failure/damage of the system when the system has been purchased from dealers other than Shimadzu and authorized Shimadzu distributors.
12. Failure/damage of the system caused by hitting or dropping the unit or exposing it to a shock.

Servicing after the expiration of the guarantee period will be offered at a charge. Contact your nearest Shimadzu service center.

WARNING

NEVER REPAIR OR CHECK INSIDE THE EQUIPMENT !

Responsibility for maintenance of medical equipment is the responsibility of the user. This equipment should only be operated by, or under the direct supervision of, a suitably qualified person.
For any repair or maintenance of this equipment contact your nearest authorized Shimadzu service center.

WARNING

NEVER MODIFY THE EQUIPMEHT !

Modification of the equipment by a user is prohibited as detailed in paragraph 7 of the “Operating Precautions (for both the Safety and Prevention of Danger) in the Use of Medical Equipment” (the Notification No.495 by the Chief of the Pharmaceutical Affairs Bureau, the Ministry of Health and Welfare dated June 1, 1972).
Please Note: The Pharmaceutical Affairs Law of Japan prevents unauthorized modification of this equipment without authorisation.

WARNING

PERFORM PERIODICAL INSPECTIONS !

Preventive maintenance is essential to ensure the long term operational safety and performance of this system.
This instruction manual gives detailed description of the periodical maintenance and inspections that should be performed on this equipment.
For the maintenance and inspections that require qualified specialists to perform the “Maintenance Agreement” offered by authorized Shimadzu service center is recommended.

WARNING

PRECAUTIONS FOR X-RAY IRRADIATION

When using X-ray equipment incorrectly, the operator and patient may become exposed to unnecessary irradiation. Special care to ensure that only the patient stays in the examination room when X-rays are exposed. If it is necessary for another person, other than patient, to be in the examination room, ensure that appropriate protective measures are provided.

WARNING

PRODUCT SAFETY

Do not operate this equipment if there is any uncertainty as to the proper functioning of the system. Refer all servicing to qualified service personnel.

CONSIDERATION FOR MECHANICAL SAFETY

Be careful when operating this equipment. Be aware operators and patient's body - hand, foot, etc. - may not be got jammed between moving parts of the system or between the unit and other equipment when moving a part of the unit.

NEVER USE THIS SYSTEM AT A PLACE WHERE FLAMMABLE OR EXPLOSIVE GASES MAY BE PRESENT.

This system is not explosion-proof. Never use this equipment at a place where flammable or explosive gases may be present.

ABOUT ELECTRICAL EARTHING

Connect the power cord plug to a socket with an electrical earthing terminal.

DO NOT SPLASH WATER ON THIS EQUIPMENT !

Do not splash water on this equipment, because there is a risk of electric shock. To clean the equipment, wipe the surfaces with a cloth dampened with antibacterial solution.

THE SYSTEM MAY FALL OVER, IF IT IS OPERATED ON A SURFACE INCLINED MORE THAN 5 DEGREES.

When operating the tube arm of the equipment make sure the equipment is located on level ground or floor where the slope is less than 5 degrees.

The operator should set the focal spot to skin distance as large as practible to ensure the absorbed dose to the patient is as low as possible.

PAY ATTENTION TO OBSTACLES DURING DRIVING THE UNIT!

If the unit hits obstacles during driving and the force applied to the bumper switch by the hitting is less than 2 kg, the front bumper switch will not detect the obstacle.

CAUTION

PLEASE BE SURE TO AGING THE X-RAY TUBE !

When using an X-ray tube, a running-in operation called aging is required. Please aging the X-ray tube with reference to "6.3 Aging the X-ray tube."

CAUTION

Protection from ionizing radiation : Use protective devices and protective clothing as necessary.

CAUTION

The software (Operating system, OS) installed in this device runs under Windows XP. Do not change any of the OS settings. If the OS settings are changed, device operation after those changes is not guaranteed.

CAUTION

Accidents due to operation errors or unforeseen causes can result in deleting or damage to stored hard disk data (i.e. images and data). Thus, be sure to backup (archive) important data to an external file system, or print out the file data. Additionally, since external file systems also have the danger of being damaged, be sure to perform multiple backups to prevent data deletion, damage or loss.

Also, Shimadzu Corporation assumes no liability for the loss or damage to any customer data.

CAUTION

Do not turn the main power breaker OFF during the normal operation of this device. Turning the breaker OFF can result in device damage, an operation error or data loss or damage.

CAUTION

Be sure to follow the procedures described in this manual to start or stop this product. Also, do not turn the main power breaker OFF during normal operation of this device, and especially during the operation of this device's internal magnetic disk. Turning the breaker OFF can result in device damage, an operation error or data loss or damage.

CAUTION

Connect peripheral units (external recording media, etc.) which conform to IEC60601-1 to USB connector on the top cover.
Use of a non-conforming unit can cause a device accident, operation error, smoking, overheating, electric shock, and/or damage or loss of data.

CAUTION

Shimadzu Corporation assumes no liability in the event of data deletion or damage, device accident or damage, or loss occurs due to the installation of software or the connection of a peripheral unit that is not designated by Shimadzu Corporation.

CAUTION

Shimadzu Corporation assumes no liability in the event of data deletion or damage, device accident or damage, or loss occurs due to the modification or deletion of this software's setting files (Autoexec.bat, config.sys, etc.) and DR system software files.

CAUTION

Shimadzu Corporation assumes no liability in the event of device data deletion, damage or loss, due to an operation error or sudden accident.

Software License Agreement

The software used in this product is copyrighted by Shimadzu Corporation, who possesses all rights, including sublicenses for those rights (for copyrights, etc.) held by third parties.

The Customer and Shimadzu have the following agreement concerning the usage of this software.

1. Application

i. This software (hereafter "the software") includes all software programs, additional data and the Installation Guide used by this device.

2. Rights

i. The Customer is allowed to use this software with a single (1) device.

ii. If the customer wishes to transfer all of their rights to this software, the creation of a copy of this software is prohibited and this software in its entirety (the program, and all its media and user documentation, including this Installation Guide) must be transferred. The assignor is then assumed to be legally bound by the terms and conditions of this agreement.

iii. The Customer shall not, in all or in part, loan, lease, sub-license, reproduce, modify, edit, reverse-engineer, reverse-compile, or reverse-assemble this software. These actions also are not allowed by third parties.

3. Copyright

i. Shimadzu Corporation retains all this software's ownership, copyright, and software-related intellectual property rights.

NOTE

Use the following cassettes for the bucky device.Other cassettes should not be used.
CM or INCH size cassettes based on IEC standard 60406.
Attenuation equivalent not greater than 1.6mm Al.
Less than 15mm thickness.
All parts of the cassette such as hinges, locks and marking device shall be within the minimum radii for carners and edges.
Flatness shall be less than 1mm warp.

Language of Approved Version

NOTE

Original version of this manual is approved in English.

Software Revision

This manual applies to the software revision 1.0

Disposal of the Products and Parts

This system contains materials that can contaminate the environment not displosed of properly. For the disposal of this product or any of its attachments, contact your nearest authorized Shimadzu service center.

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Chapter 1

Introduction

Chapter Contents

Introduction

Introduction

This manual provides information pertaining to the system's description, operation, and specifications.

Review the Canon (CXDI-50G) Manual to understand the operation of the acquisition system.

Read this manual carefully to ensure correct use. Be sure that the warnings (NOTES and CAUTIONS) detailed in this instruction manual are fully understood when operating this product.

After reading this manual, retain it in a convenient location so that it may be referred to at any time.

This manual does not cover the X-ray tube assembly. Read the following manual for the X-ray tube assembly and Heating & Cooling Curve.

X-ray tube model name	0.7U163CS-36
X-ray tube document number	M535-E219
Heating & Cooling Curve document number	M535-E274

Chapter 2

Outline

Chapter Contents

2.1 Purpose

2.2 Features

2.3 Use Conditions

2.4 Conformity to IEC Standards

2.5 Classification of Equipment

2.6 Safety Symbols for System

2.1 Purpose

The mobile X-ray system has been designed to deliver exceptional mobile X-ray performance and image quality. It will also ensure optimum operator and patient safety.

CAUTION

Do not use the unit for any other purpose. Do not connect the unit to any other equipment by electrical or mechanical means. Unauthorized modification to any part of this equipment may compromise the patient and operator safety and will void all the manufacturer's warranty conditions.

2.2 Features

Smooth and quiet movement

The system may be moved quietly and smoothly with its power assisted drive mechanism.

Compact design

The unit, with its exceptional forward view, can be moved into limited spaces confidently and with complete control.

Easy positioning

The unit may be moved into position easily and speedily with the unique positioning central switches (Inch –mover) mounted on the x-ray tube head.

Immediate response

Three seconds after an exposure is taken a thumb nail image appears on the display, allowing on-site image confirmation.

High throughput

Improves workflow by both eliminating cassette preparation, image development, and reading in of CR, and using the hospital’s internal network to send image data to an imager or PACS.

High-frequency inverter

Use of Shimadzu's high-frequency inverter technology, with a maximum frequency of 60 kHz, generates the high voltage with the lowest ripple factor available, ensuring an efficient X-ray generation.

Anatomical programs

Anatomical programs are installed as standard, facilitating the setting of optimum exposure conditions.

Cordless system

The built-in battery power-supply enables X-ray exposures to be generated without requiring the equipment to be connected to the main electrical supply.

Plain indicator

The large indicator provides a plain indication of proceeding from the preparation to the completion of an exposure.

.

2.3 Use Conditions

2.3.1 Environmental Conditions

Use environment

Ambient temperature	:	10°C ~ 35°C
Relative humidity	:	30% ~ 75% (no dew condensation)
Atmospheric pressure	:	700 hPa ~ 1060 hPa

Storage environment (not for transport and storage before delivery)

Ambient temperature	:	-10°C ~ 40°C
Relative humidity	:	30% ~ 60% (no dew condensation)
Atmospheric pressure	:	700 hPa ~ 1060 hPa

CAUTION

Charge the battery in the use environment.
Do not charge in the storage environment.

Power supply

AC power

System	:	Single phase AC
Frequency	:	50/60 Hz
Standard voltages	:	100, 110, 120, 200, 220, 230, 240 V (set one of the voltages when installing)
Voltage variation range	:	±10% of standard voltages
Supply capacity	:	1kVA
Power Supply Impedance	:	100, 110, 120 V : No more than 1.0Ω 200, 220, 230, 240 V : No more than 4.0Ω

Earth

Earth terminal	:	Earth resistance of no more than 100Ω
Additional earth terminal	:	Earth resistance of no more than 100Ω

2.3.2 EMC (Electro-Magnetic Compatibility)

This system belongs to Group 1 and Class A equipment in accordance with EN60601-1-2:2001.

The system uses radio-frequency energy for its internal function only and this is not intended to deliver energy to the patient. However, radio-frequency energy can affect other highly sensitive equipment.

The system's main power line in the clinical site should be connected to the domestic power sources which are separated from the public main network.

2.4 Conformity to IEC Standards

IEC standards to which the system conforms are below:

IEC 60601-1:1988 +A1 : 1991 + A2 : 1995

IEC 60601-1-2:2001

IEC 60601-1-3:1994

IEC 60601-1-4:1996:2000Ed.1.1

IEC 60601-2-7:1998

IEC 60601-2-28:1993

IEC 60601-2-32:1994

2.5 Classification of Equipment

The method of protection against electric shock

Internally powered equipment (when powered by the battery)

Class I equipment (during charging)

The degree of protection against electric shock

Type B equipment

The degree of protection against harmful ingress of water

Ordinary equipment

The main body of this system is not protected against immersion into a liquid. Never use this unit in a place in which immersion into a liquid may occur. Never spill liquid on the surface or in the inside of this system. Otherwise, electrical shock may occur. When liquid is spilt, contact your nearest authorized Shimadzu service center.

The degree of safety of application in the presence of a flammable

Anesthetic mixtures with air or with oxygen or nitrous oxide

Equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide

Risk of explosion if used in the presence of flammable anesthetics.

The mode of operation

Continuous operation with intermittent loading

2.6 Safety Symbols for System

Safety symbols displayed on the system are described below:

Symbol	Location	Meaning
	In name plate on covers	alternating current
	Inside the instrument, where wiring earth conductor is connected	Earthing function
	Inside the instrument, where the protective earth conductor in the power cord is connected	Protection earthing
	In the name plate on covers	Safety classification: Type B
	On the power supply panel	Power on
	On the power supply panel	Power off
	On warning/caution labels Refer to Operation Manual	Attention:
	Inside X-ray tube cover	Risk of electric shock
	On X-ray tube cover	Ionizing radiation

Chapter 3

Descriptions of Each Part

Chapter Contents

3.1 Outside View

3.2 X-ray Control Panel

3.3 Power Supply Panel

3.4 Touch Panel Monitor

3.5 Hand Switch

3.6 Driving Handle Section

3.7 X-ray Tube Operating Section and Collimator

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3.13 Apron Hanger

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3.16 LAN Cable for external connection

3.1 Outside View

The outside view of the system and the identification of each part are shown in Fig. 3-1.

Fig. 3-1 Outside view of the system

3.2 X-ray Control Panel

The descriptions and basic functions of the X-ray control panel (Fig. 3-2) are shown in Table 3-1 and Table 3-2.

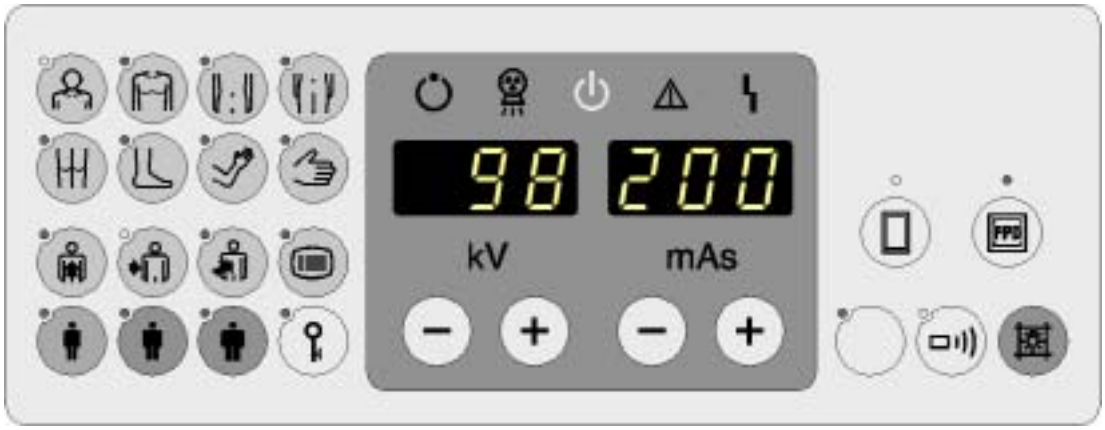


Fig. 3- 2 X-ray control panel

Table 3-1 Description and basic function of each switch

No.	Switch	Description	Normal function
1		Head	Selects exposure for head region (head, face, nose, ear, neck, etc.)
2		Chest	Selects exposure for chest region (collar bone, rib, blade bone, thoracic spine, etc.)
3		Abdomen	Selects exposure for abdomen region (abdomen, lumbar, etc.)
4		Waist	Selects exposure for waist region (pelvis, coccyx, embryo, femur, etc.)
5		Leg	Selects exposure for leg region (knee, shin, etc.)
6		Foot	Selects exposure for foot region (heel, foot, toe, etc.)
7		Arm	Selects exposure for arm region (brachium, ancon, wrist, etc.)
8		Hand	Selects exposure for hand region (hand, fingers, etc.)
9		Front (AP)	Selects exposure for frontal projection

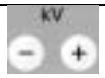
10		Side (Lateral)	Selects exposure for lateral projection
11		Oblique	Selects exposure for oblique position
12		User setting	Refer to “4.8 User Setting”
13		Thin	Selects “Thin”
14		Normal	Selects “Normal”
15		Obese	Selects “Obese”
16		Registration	Registers anatomical programs
17		X-ray tube voltage	Sets X-ray tube voltage
18		Current time product	Sets the current time product
19		Remote controller	Switches between enable (LED on) and disable (LED off) of remote controller
20		Collimator lamp	Switches between “ON” and “OFF” of collimator lamp Also used for “Bumper Switch Cancel Function” in combination with the key switch (refer to “4.2.4 Bumper Switch”)
21		FPD select	Selects FPD device Radiography exposure.
22		GR select	Selects General Radiography exposure.

Table 3-2 Name and function of the symbols and displays

Indicator/ Display	Description	Normal function
	Ready Up[*1]	Illuminates when the system is ready for making exposures
	X-ray exposure	Stays on while X-ray is being radiated
	Stand-by	Illuminates when the system is in stand-by mode
	Attention	Illuminates if any situations where X-ray can not be radiated
	Disturbance	Illuminates if any fault that disables X-ray radiation has occurred
	kV display	Displays set kV value
	mAs display	Displays set mAs value

[*1] Ready Up: Indicates that the preparation for exposure has been completed and the system is ready for X-ray exposure.
When using the DR system, check that the Touch panel monitor's Ready display is lit before performing the X-ray exposure.

Ready: Indicates that the system is preparing for X-ray exposures.

3.3 Power Supply Panel

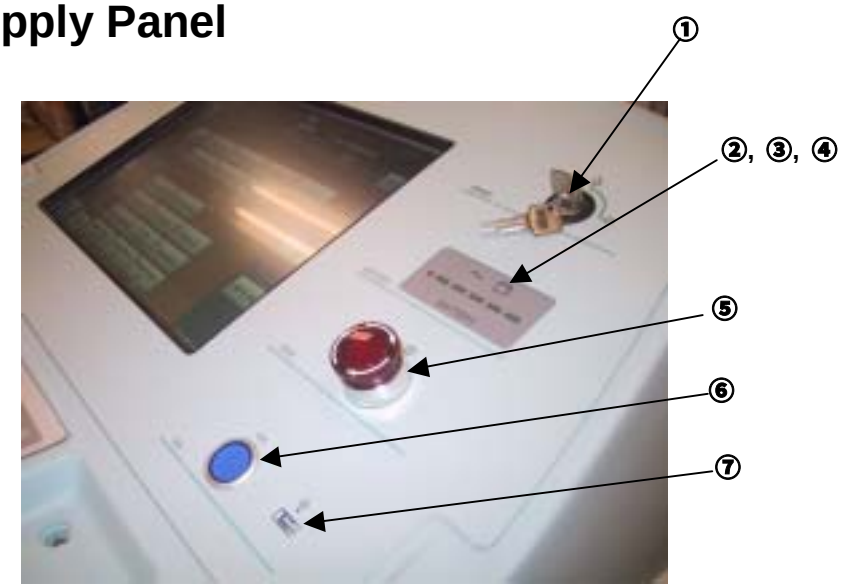


Fig. 3-3 Power supply panel

① **Key switch**
This switch turns power "ON" or "OFF" for systems with key operation.
The key can be removed only at the power "Off" position.

② **Power line connection indicator lamp** ∼
This lamp illuminates when the equipment is connected to the main power outlet and power is supplied to the system from the outlet.

③ **Charging lamp**
This lamp illuminates while the battery is being charged. It turns off when the charging is complete.

④ **Battery indicator**
This indicator normally indicates the amount of energy remaining in the battery.
It indicates charging state while the battery is being charged.

⑤ **Emergency stop switch**
The switch is used to disconnect the equipment in any emergency situation.
For details, refer to "4.3 Emergency Stop Switch".

⑥ **DR switch**
The switch is used to start DR system.
For DR system usage information, refer to the Canon's CXDI Manual.

⑦ **USB connector**

Connects an external storage media. (A hard disk or USB memory unit.)

CAUTION

Connect peripheral units (external recording media, etc.) which conform to IEC60601-1 to this device's USB connector.

Use of a non-conforming unit can cause a device accident, operation error, smoking, overheating, electric shock, and/or damage or loss of data.

3.4 Touch Panel Monitor

The Color Touch Panel monitor is controlled by a PC that is mounted inside the Mobile unit and uses the Windows XP operating system. When the unit is turned on, the PC will boot and begin CXDI program.

The software can be operated by simple touch the screen in the area of interest. A finger touch simulates right clicking that area with a mouse curser.

A detail description of the screens can be found in the CXDI series Operation Manual.

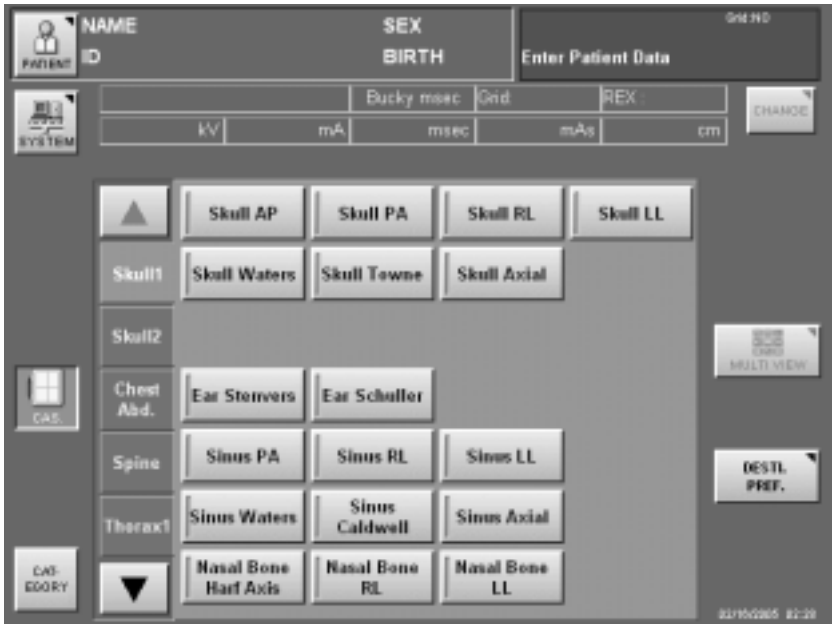


Fig. 3- 4 Touch Panel monitor

CAUTION

Do not place or hang objects on the touch panel. This can lead to touch panel damage. Do not press on the panel with a sharp, pointed object, subject it to strong shocks or scratch the panel. These can all lead to touch panel damage or cause an accident. If the touch panel's internal liquid leaks from the touch panel and enters the body, it will have a poisonous effect.

3.5 Hand Switch

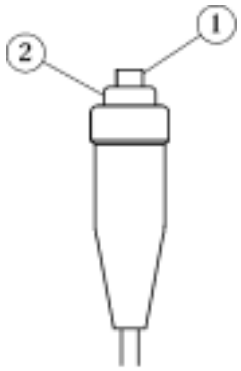


Fig. 3-5 Hand switch

① **Exposure-preparation switch (first position)**
When this switch is pushed on, the Ready-Up indicator illuminates and the system is prepared for an exposure.

If this switch is pushed momentarily and then immediately released, the collimator lamp can be turned on. Repeating this procedure will turn the light off.

If this operation is performed while the collimator lamp is on, the lamp can be turned off. The system will automatically turn call light off at the start of an exposure.
(Refer to "4.4.3 Setting the Irradiation Field".)

② **Exposure switch (second position)**
When this switch is pressed while Ready-Up indicator is lit, X-ray is radiated.

NOTE

When using the DR system to make X-ray exposure, be sure the touch panel monitor's Ready display is lit, and then perform the X-ray exposure. If the DR system's Ready display is not lit and an exposure is taken, the error message F68 will appear and X-ray exposure cannot be performed.

3.6 Driving Handle Section

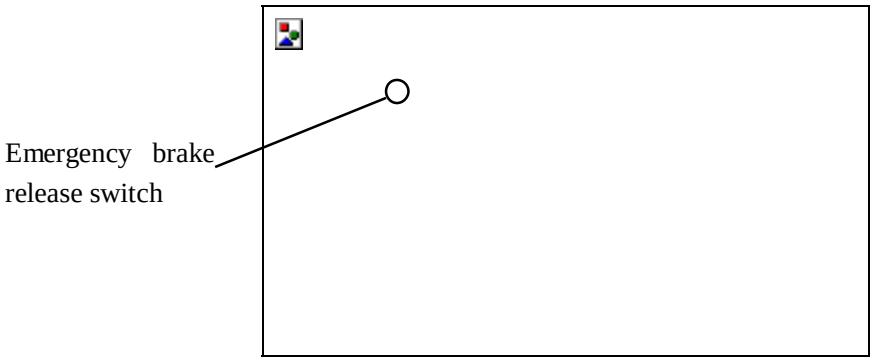


Fig. 3-6 Driving handle

This is the handle for moving the system.

The brake can be released by gripping the bar on the lower surface of the handle.

By pushing the handle while releasing the brake, the system can be moved in the desired direction.

Do not touch the bar on the lower surface of the handle unless you want to move the system. This is the brake release and touching this bar on the lower surface of the handle will release the brake and the system may move.

3.7 X-ray Tube Operating Section and Collimator

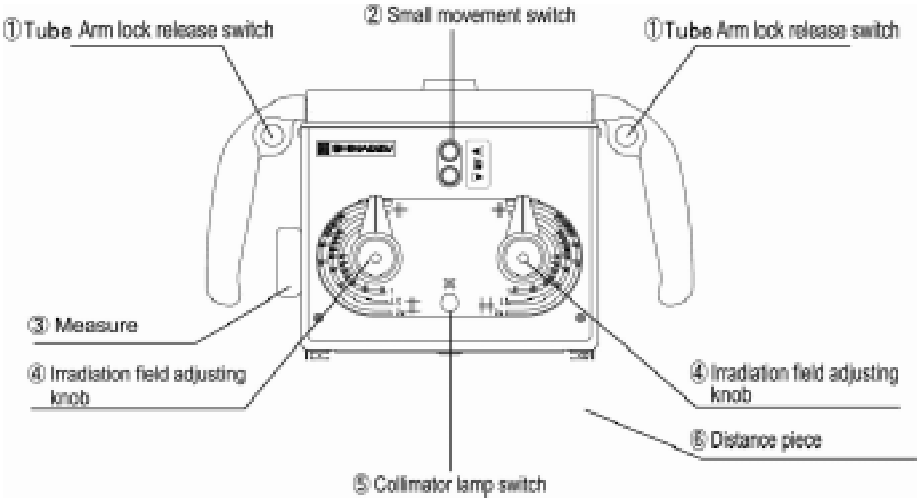

① Tube Arm lock release switch
② Small movement switch
① Tube Arm lock release switch
③ Measure
④ Irradiation field adjusting knob
④ Irradiation field adjusting knob
⑤ Distance piece
⑤ Collimator lamp switch

Fig. 3- 7-ray tube operating section and collimator

③ Tube arm lock release switch

Pressing the “Tube arm lock release switch” can unlock the support stand, thus allowing the X-ray tube assembly to be moved into position.

④ Small movement switch

When the tube arm is unlocked, pressing the “Small movement switch” will move the system slowly forward or backward (approx. 5 cm/s). When the tube arm is locked, the system cannot be moved.

The small movement function will automatically stop after 10 seconds of use.

⑤ Measure

This is used to measure SID (distance between focus and film) before an exposure is initiated.

⑥ Irradiation field adjusting knob

This knob adjusts the size of irradiation field.

⑦ Collimator lamp switch

This switch has the same function as the “Collimator lamp key” ☐ on the X-ray control panel.
It can turn the collimator lamp “ON” or “OFF”.

⑧ Distance piece

This piece sets the minimum distance that the collimator must keep from a patient’s body during an X-ray exposure.

Control panel on collimator

When adjusting the size of the radiation field, use the two control knobs on the front of the collimator as shown in Fig. 3-7.

The left knob is for the transverse field adjustment, and the right knob is for the longitudinal one. The face of the collimator shows the direction of the blade movements as shown in Fig. 3-7.

Numbers on the three striped parts show the field sizes in “cm” unit, calibrated 1m, 1.5m, 2m SIDs, respectively. Numbers on the other parts show those in “inch” units for the 3 SIDs as in “cm”, respectively.

For instance, when field size is to be 17 x 17 inches (43 x 43cm) at 1m SID, adjust the control knob to be shown in Fig. 3-7.

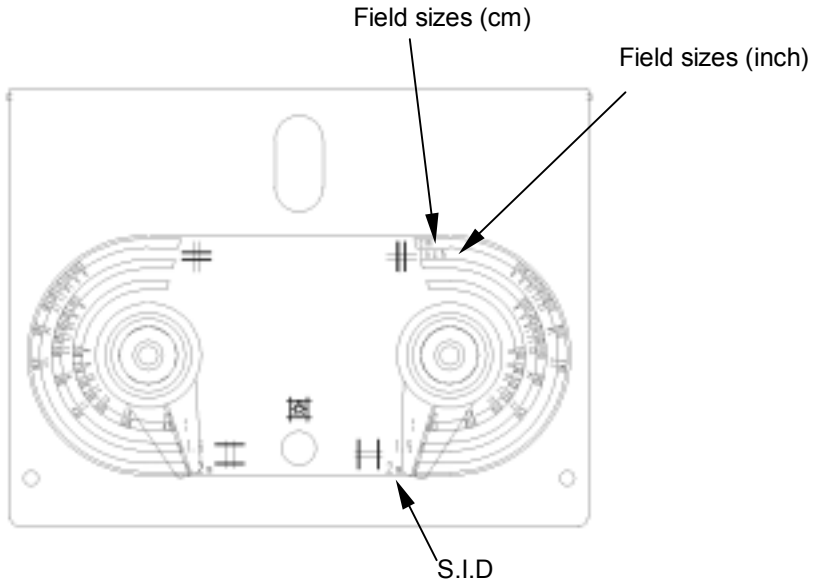


Fig. 3- 8 Control panel on collimator

3.8 Operation Handle

Pressing “the arm-lock release switch” unlocks the column rotation, X-ray tube up/down, and arm extension/contraction.

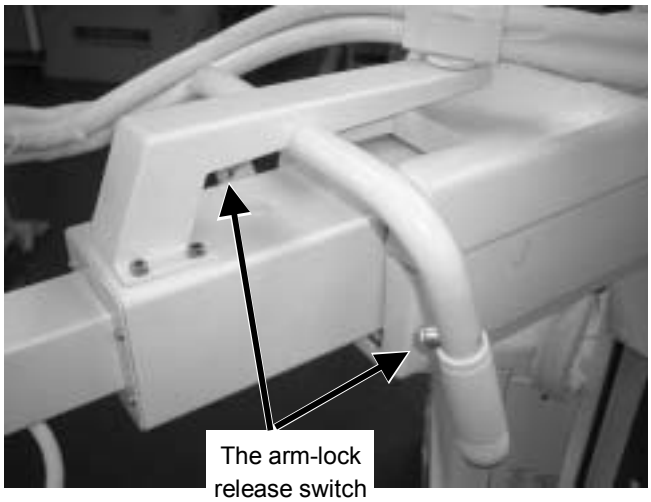


Fig. 3- 9 Operation handle

3.9 Tube Arm Joint Section

This is the machinery that holds the tube section.

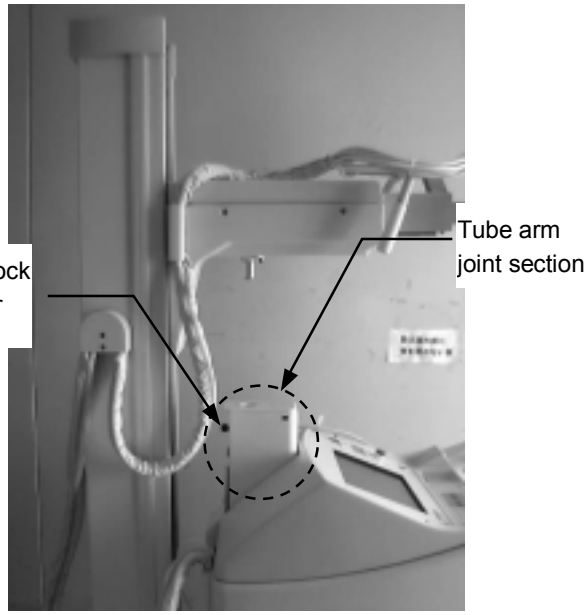


Fig. 3- 10 Tube arm joint section

① **Tube arm lock release lever**
This lever has the same function as the “Tube arm lock release switch”.

The tube arm can be unlocked by lifting up the X-ray tube assembly while pressing the “Tube arm lock release lever”.

3.10 Main Circuit Breaker and Additional Protective Electrical Earthing Wire

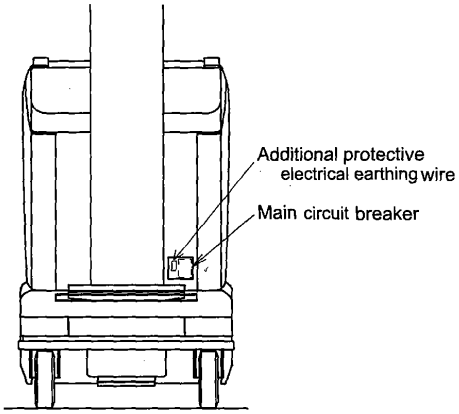


Fig. 3-11 Main Circuit Breaker and Additional Protective Electrical Earthing Wire

Main Circuit Breaker

The main circuit breaker switches on/off the connection between the battery and the internal circuits.

The system can not be used when the main circuit breaker is turned “OFF”. When the power plug is connected to an power outlet, the error message F5c will appear the X-ray control panel. Power is supplied to the system, but the battery can not be charged because it is not connected to power.
When error F5c appeared, the power plug disconnect to an power outlet. And the main circuit breaker is turned “ON”, thereafter the power plug is connected to an power outlet.

Keep turning “ON” the main circuit breaker in normal use.

It is unnecessary to access to the main circuit breaker in normal use.

Keep turning “OFF” the main circuit breaker only when not using the system for a long period of time or when transporting.

If an over-current flows from the battery, the main circuit breaker detects the over-current and automatically turns “OFF”.

If the main circuit breaker automatically turns “OFF” at frequent intervals, stop using the system and turn “OFF” the main circuit breaker, and immediately contact your nearest authorized Shimadzu service center.

Additional Protective Electrical Earthing Wire

Use the additional protective electrical Earthing wire when Earthing connection via plug might be not enough.

3.11 CXDI-50G Imaging Unit

CXDI-50G Imaging Unit

Fig. 3-12 CXDI-50G Imaging unit

TREAT THE IMAGING UNIT CAREFULLY!

Do not drop or hit anything with the imaging unit, or it might be damaged and does not work anymore.

The imaging unit is equipped with four shock detectors. This detector is normally white, and an excessive shock will cause it to change color. If the shock detector changes color, there is a chance the imaging unit is damaged or broken. Also, if the shock detector changes color, any damage incurred is outside the scope of the device's guarantee.

DO NOT PULL THE IMAGING UNIT'S CABLE!

Also, do not retract the imaging unit when the unit's cable is caught on another item. This can result in cable damage, fire or an electric shock, damage the unit or cause an accident.

DO NOT OVERLOAD THE IMAGING UNIT WITH HEAVY OBJECTS!

This can damage or break the imaging unit's sensor.
Load limits:

Uniform Load: 150kg/Entire imaging surface load: 100kg/Φ40mm
Section Load: 100kg/Φ40mm

Be sure to use the imaging unit on a level floor or stand.
If force is applied with the imaging unit at an angle, the imaging unit's internal sensor can be damaged or broken.

When handling the imaging unit, be careful not to run over the imaging unit's cable with the X-ray device's wheels, catch or cut the cable in the device's front bumper. (See Fig. 3.13)
Doing so can damage the cable, cause a fire or electric shock, and damage the device.

Fig. 3-13 Imaging unit (Cable is caught)

3.12 Imaging Unit/Grid Storage Bin

The near-side slot is used to store the imaging unit.
The rear slot is used to store the Grid Unit, cassette, grid, and protection screen.
If only cassettes are inserted, up to 3 can be inserted.

CAUTION

If the cassette is inserted in the bin when an image is taken, the film in the casette may be exposed.

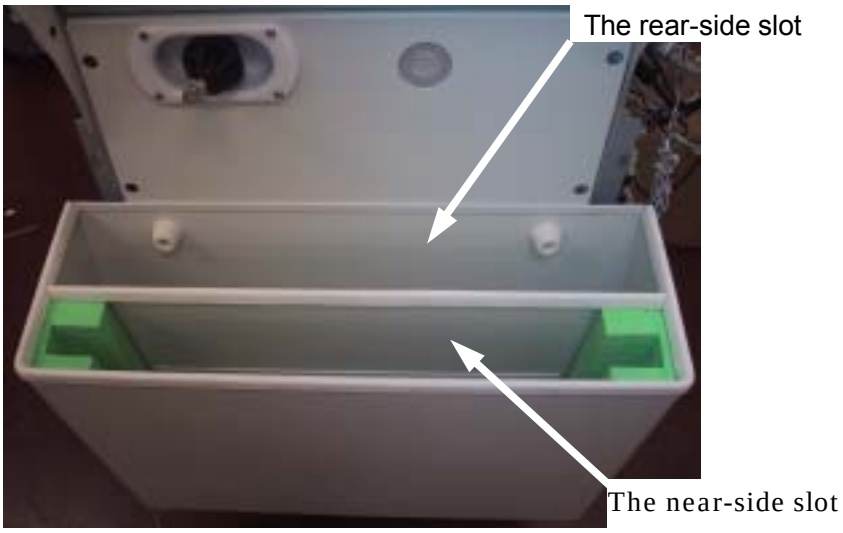


Fig. 3-14 Imaging Unit/Grid storage bin

3.13 Apron Hanger

Apron hanger and Imaging Unit Cable Attachment

X-ray protective apron can be hung on the Apron hanger.

Fig. 3-15 Apron hanger

The Apron Hanger should be placed on the hook opposite the tube support arm. The hooks on the sides of the column should be used for the cable drape. Contact your nearest authorized Shimadzu service center when you want to change the installation position.

CAUTION

Apron hanger may hang on X-ray protective apron only.

Apron hanger's useable hanging weight is less than 7kg.

When the arm is unlocked, do not hang apron on apron hanger.

Pay attention while moving the system while an apron is on the Apron hanger, especially moving the system over any step, and along a slope.

3.14 Switch for activating the emergency brake release function

Switch for activating the emergency brake release function

This switch can be activated by using the same key as the power supply panel key.

Turning the power supply panel's key switch OFF, removing the key and then turning this switch ON activates the emergency brake release function and makes it possible to release the brake with the emergency brake release switch mounted on the running handle.

The brake release lever on the running handle is disabled by activating the emergency brake release function.

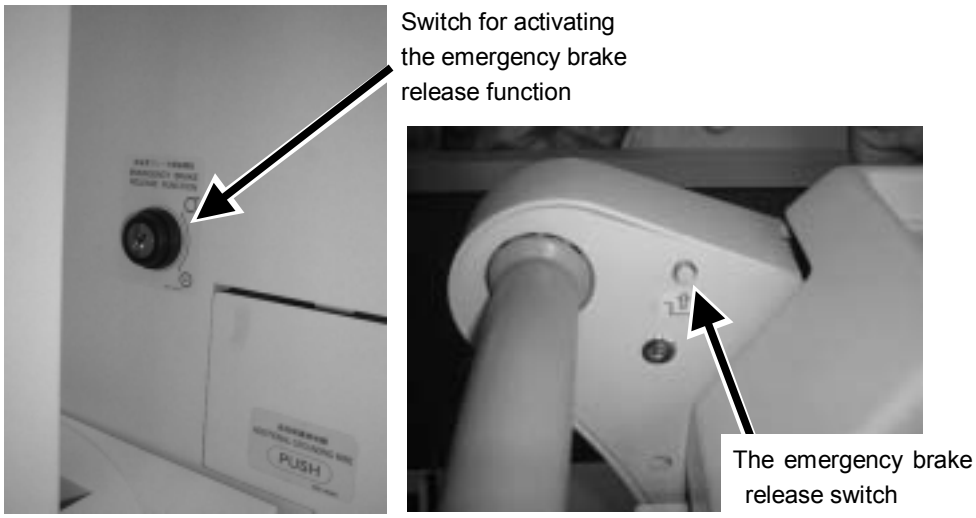


Fig. 3-16 Switch for activating the emergency brake release function

CAUTION

Do not turn on the switch to activate the emergency brake release function except in case of an emergency.

3.15 Operational State Indicator Lamp

Operational state indicator lamp

Operational state of the apparatus is indicated by a color or blink of the operational state indicator lamp.

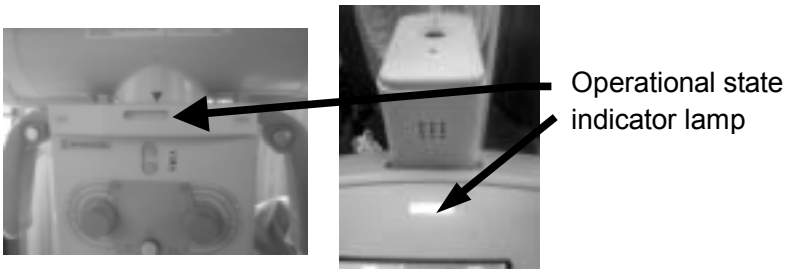


Fig. 3-17 Operational state indicator lamp

Light colors indicating various operational states are shown in .

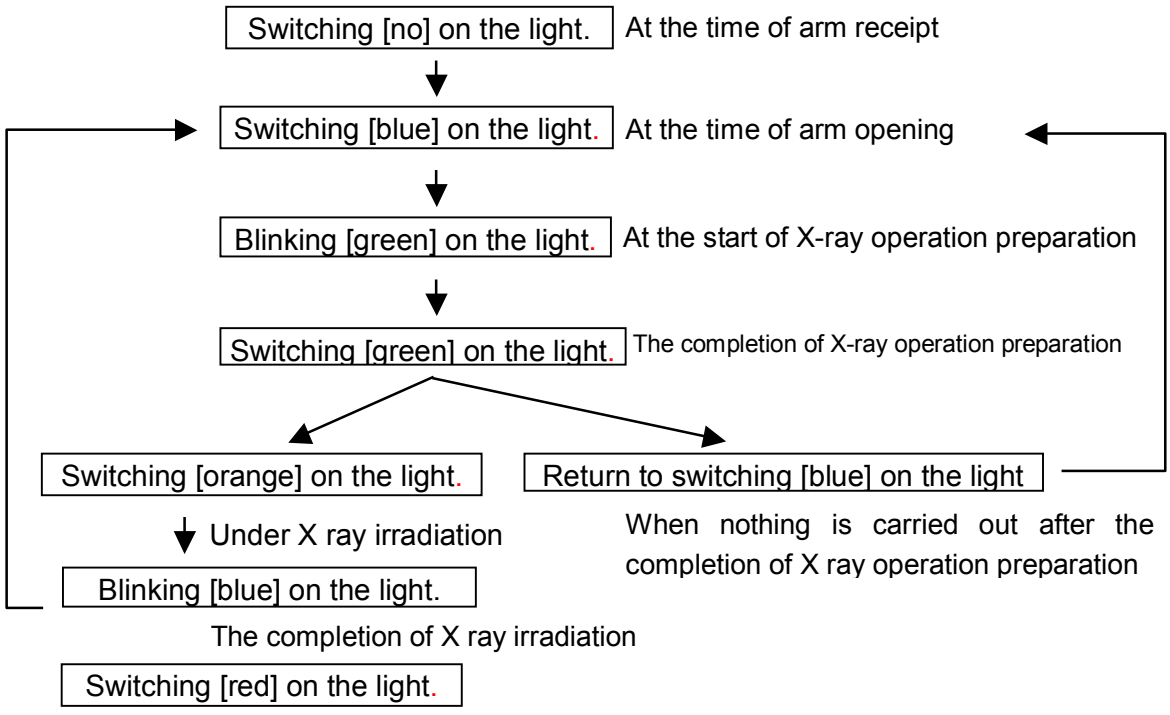

Switching [no] on the light.
At the time of arm receipt
Switching [blue] on the light.
At the time of arm opening
Blinking [green] on the light.
At the start of X-ray operation preparation
Switching [green] on the light.
The completion of X-ray operation preparation
Switching [orange] on the light.
Return to switching [blue] on the light
Under X ray irradiation
When nothing is carried out after the completion of X ray operation preparation
Blinking [blue] on the light.
The completion of X ray irradiation
Switching [red] on the light.
At the time of the abnormalities of equipments, such as a X-ray exposure system, a run system, and a charge system

Fig. 3-18 Light colors indicating various operational states

CAUTION

Be cautious! Prevent water or the like from entering inside of the state indicator lamp. Otherwise, the lamp may not come on.

3.16 LAN Cable for external connection

LAN cable for external connection

Images saved in the device can be output to a DICOM printer, workstation. Pull out the LAN cable from the bottom of the drive handle and connect it to the printer or workstation.

Fig. 3- 19 LAN cable for external connection

CAUTION

Connect the LAN cable to the printer,workstation,PACS and other units which conform to IEC60601-1.

Use of a non-conforming unit can cause a device accident, operation error, smoking, overheating, electric shock, and/or damage or loss of data.

No Text

Chapter 4

How to Operate

Chapter Contents

4.1 Operation table

4.2 Starting and Stopping the System

4.3 Moving the System

4.4 Emergency Stop Switch

4.5 Tube Arm Operations

4.6 How to Change Exposure Condition

4.7 Making an X-ray Exposure

4.8 Charging the Battery

4.9 User Setting

4.10 Emergency Brake Release Function

4.1 Operation table

4.1.1 Operation table

The operation and the use function are different according to the state of the Mobile DaRt.Relation of the state of the Mobile DaRt usual operation and function are described as follows.Refer to the explanation of the method of each operation and function for details.

Table 4-1 Operation table of Power on/off

	Key switch	Main breaker
Power on	**ON**	**ON**
Power off	**OFF**	NOTE1

NOTE**1**：Turn off the key switch and main breaker when the system moves abnormally.

Table 4-2 Operation table of DR system Start up/Shutdown

	Key switch	DR switch	Shutdown button	Main breaker
Start up	**ON**	**ON**		**ON**
Shutdown			Push	NOTE2

NOTE 2：Turn off the key switch and main breaker when the system moves abnormally.

Table 4-3 Operation table of Battery charge

	Key switch	**DR** switch	Power lead	Main Breaker
Battery Charge	**OFF**	**OFF**	Connect NOTE**3**	**ON** NOTE**3**

NOTE 3：Disconnect power plug for power outlet and turn off the main breaker when the system moves abnormally.

Table 4-4 Operation table of Moving system.

	Key switch	Bumper switch	Main breaker	Tube Arm lock	Driving handle	Brake bar	Small movement switch	Emergency switch	Power lead	Hand switch
Normal Travel mode	ON	OFF	ON	Lock	Push NOTE5	Grip	Don't touch	OFF NOTE5	Disco nnect	Don't touch
Slow Travel mode	ON	OFF	ON	Release	Push NOTE5	Grip	Don't touch	OFF NOTE5	Disco nnect	Don't touch
Small Movement	ON	OFF	ON	Release	Don't touch	Don't touch	ON NOTE4 NOTE5	OFF NOTE5	Disco nnect	Don't touch

NOTE4: Push either switch of Forward small movement or badkward small movement

NOTE5: Push the Emergency swith when you do movement with a suspicious Mobli Dart.

Table 4-5 Operation table of X-ray exposure

	Key switch	DR system	Main breaker	Tube Arm lock	Driving handle	Brake bar	Small movement switch	Emergency switch	Power lead	Hand switch
FPD device Radiography	ON	REA DY	ON	Release	Don't touch	Don't touch	Don't touch	OFF	Disco nnect	Ready + X-ray
General Radiography	ON		ON	Release	Don't touch	Don't touch	Don't touch	OFF	Disco nnect	Ready + X-ray

Table 4-6Operation table of Emergency brake release

	Switch for activating the emergency brake release function	Emergency brake release switch	Key switch
Emergency brake release function	**ON**	Push	**OFF**

4.2 Starting and Stopping the System

4.2.1 Starting the System

To start the system, turn the key switch to “ON” position ⊙.

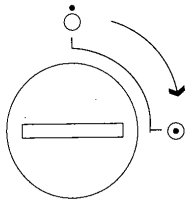


Fig. 4-1 Key switch “ON”

It takes approximately 2 seconds to check the functions of the system and then the remaining charge of the battery is indicated on the battery indicator. After the status of the battery charge has been indicated, running of the system, "Tube Arm Lock" release, and X-ray exposure are enabled.

If the red LED (the left LED of the meter) is lit (① and ② in the table below), the battery must be charged. Refer to “4.7 Charging the Battery” for the battery charging procedure.

Table 4-1 Battery remaining charge indicator

	Indicator	Battery condition
①	■ □□□□□	Only moving the system is possible.
②	■ ■□□□□	Moving and making exposures are possible.
③	□ ■□□□□ ～ □ ■■■■■	Moving and making exposures are possible.

■ shows ON, and □ shows OFF.

NOTE

If the key switch is turned on when the switch or lever has been turned on, code d4 to d11 appears on the mAs display. Release the switch or lever.

With the hand switch pressed and the key-switch turned “ON”, the mAs display will show codes F64 and F65. Release the hand switch.

It is possible to change the APR to be indicated at the time of starting the apparatus according to your request. Refer to “4.9 User setting”.

4.2.2 Stopping the System

To stop the system, turn the key switch to “OFF” position ⏻.

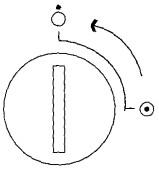


Fig. 4-2 Key switch “OFF”

CAUTION

When the equipment is not being used, turn the key switch to “OFF” position ⏻, and remove the key.

Also, check that the DR system is stopped and move away from the system.

NOTE

When not using the system for a long period of time, turn “OFF” the main circuit breaker.

Auto-power-off function

The auto-power-off function stops the system if the system is not used for a long time even with the key switch “ON” ⊙.

The auto-power-off function is set for 15 minutes by the factory. The auto-power-off time setting can be changed to one of the followings as necessary: (Refer to “4.8 User Setting”.)

Set time: 5 min., 10 min., 15 min., 20 min., and 30 min.

No auto-power-off

To reset from the auto-power-off condition, turn the key switch “OFF” ⏻, wait three seconds and then “ON” ⊙.

CAUTION

Auto power off does not stop the DR system.

Be sure to check that the DR system is stopped. Turn the key switch to the "OFF" position, remove the key and move away from the system.
If the auto-power-off function stops the system, the DR system is not stopped.
If the system is left unused while the DR system is running, the battery will be dtscharaed.

NOTE

Be sure to turn the key switch to "OFF" position after use.
If the system is turned off by the auto-power-off function without turning the key switch "OFF" and left unused for a long time, the battery will continue to be slowly discharged.

NOTE

When the power plug is connected to a power outlet, the auto-power-off function is disabled. After using the system, return the system to the predetermined storage location and turn the key switch to "OFF" position. Also, be sure to check that the DR system is stopped.

4.2.3 Starting Up the DR System

CAUTION

When not using the system, be sure to stop the DR system.

Turn the key switch to the "OFF" position, remove the key, check that the DR system is stopped and move away from the device.

When the power cable plug is not connected to the power outlet:

Turn the key switch to the "ON" position.
Press the top cover's DR switch.
The DR system will start.
For detailed DR System operation information, refer to Canon's CXDI Manual.

When the power cable plug is connected to the power outlet:

Turn the key switch to the "ON" position. The battery will stop charging.
Press the top cover's DR switch.
The DR system will start.
The error message "Imaging unit: Sensor Unit : Detect Error (-5100) will appear.
When it does, press the [OK] button.
For detailed DR System operation information, refer to Canon's CXDI Manual.

CAUTION

Battery charging is not possible while the DR system is running.

After use of the DR system is finished, stop the DR system, turn the key switch "OFF" and plug the power cable into the power outlet to begin charging.

4.2.4 Stopping the DR System

Press the touch panel monitor's DR shutdown button.

After the DR system's shutdown processing is completed the DR system will stop.

CAUTION

When the DR system is stopped, press the touch panel monitor's DR shutdown button.

While the DR system is operating, turning the key switch to OFF will not stop the DR system. While the DR system is operating, even though the system is stopped by the auto power off function, the DR system is not stopped.

CAUTION

When standing away from the system, be sure to stop the DR system.
Also, turn the key switch to the "OFF" position, remove the key, check that the DR system is stopped and move away from the device.

NOTE

After use of the DR system is finished, be sure to stop the DR system. If the system is left unused while the DR device is running, the battery will be discharged.

NOTE

If the DR system does not respond when a button is pressed or the DR system's opeation is not normal, turn the key switch "OFF", turn the main breaker "OFF" and stop the DR system.

4.3 Moving the System

WARNING

Make sure that there are no obstacles in the way when moving the system. If the system hits a drip infusion stand or runs over cables of other equipment, it may pose a serious danger to the patient. The bumper switch on the front of the system may not detect anything light in weight such as drip infusion stand or cables from other equipment.

WARNING

During the normal travel mode (where the tube arm is locked), do not move the system over any step higher than 5 cm or along a slope steeper than 7 degrees. When stopping the system, always park it in a level place. Otherwise, the system could roll down a slope or topple over.

CAUTION

To stop the unit in any emergency press the "Emergency stop switch" on the power supply panel.

If you press the "Emergency stop switch", it will not be possible to make any x-ray exposures. When resetting the "Emergency stop switch", watch to see that the system does not make any abnormal movements. If the system moves abnormally, stop using the system and contact your nearest authorized Shimadzu service center.

CAUTION

If the red LED of the battery indicator is lit, immediately charge the battery.

NOTE

The brake can not be released and the system cannot be moved from the time you begin the preparation for exposure to the end of the exposure.

NOTE

When the power cord is connected to a main power outlet (and the power light indicator is lit), it will not be possible to drive the unit.
However, if the key switch is turned to "ON" position ⊙, battery charging is stopped, then only the release of the brake is possible.

NOTE

When the device is moved by the electrified body, you may feel the shock of static electricity according to conditions such as humidity and clothing.

CAUTION

To keep the system still, do not touch the bar beneath the handle.
The break release is on the bar beneath the handle. Be careful not to accidentally press it or the system may move unexpectedly.

4.3.1 Imaging Unit Storage During Movement

When moving the device, be sure to stow the Imaging unit securely in the storage bin. (Fig. 4-3 and Fig. 4-4)

Fig. 4-3 View of stored imaging unit

Fig. 4-4 View of stored imaging unit's cable

CAUTION

Be sure not to bump the imaging unit against another object, drop it or subject it to strong shocks. Also, do not crimp, stretch or step on the imaging unit's cable. Doing so can cause a fire or electric shock, and can damage the unit or cause an accident.

4.3.2 Normal Travel Mode

When the tube arm is locked (refer to “4.4.1 Tube Arm Lock”), the system is in the normal travel mode.

By applying a force to the handle while gripping the brake lever on the lower surface of the handle, the system moves in the direction of the applied pressure. The moving speed varies according to the pressure applied to the handle with the power-assisted drive mechanism. The maximum speed is approximately 5 km/h. The power-assisted drive mechanism can be set to one of the 15 steps from “light” to “heavy”. The acceleration can be set to one of the 15 steps from "easy to accelerate (light)" to "slowly to accelerate (heavy)". The steer control can be set to one of the 11 steps from “easy turn” to “easy straight”. The backward power-assisted drive mechanism can be set to one of the 11 steps from “light” to “heavy”. Refer to “4.8 User Setting”.

4.3.3 Slow Travel Mode

If the tube arm is not locked (refer to “4.4.1 Tube Arm Lock”), the unit will automatically select the slow travel mode and the traveling speed of the system will be limited to about half the normal speed. In this case, the strength of the power-assisted drive is limited to about half of its normal power.

Do not allow the unit to climb over a step during the slow travel mode.

Otherwise, the system may topple over because the tube arm is not locked.

4.3.4 Small Movement Switch

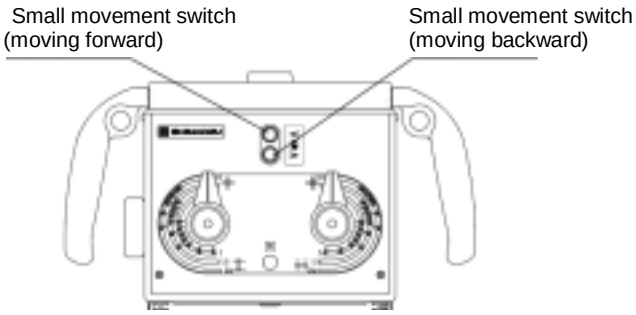


Fig. 4-5 Small movement switch

WARNING

When moving the system by the small movement switch, make sure that there are no obstacles around the system.

If the system hits a drip infusion stand or runs over cables of other equipment then the system may pose a serious danger to a patient.

Caution is required when the system is located on the opposite side of the bed. The operator may not be able to see the base of the system. The bumper switch on the front of the system may not detect anything light in weight such as drip infusion stands or cables from other equipment.

The small movement switch makes it possible to move the system forward and backward more slowly than in the slow travel mode.

If the small movement switch continues to be pressed with the tube arm unlocked, the system moves forward or backward. The maximum speed is approx. 5 cm/s.

The small movement switch automatically terminates after approx. 10 seconds. When further movement is required, repeat the process.

If the system can not be moved due to thick carpet, etc., move it with the running handle, because the driving motor power in the small movement mode is much less than in the slow travel mode.

CAUTION

If the small movement switch should fail while it is pressed down, the system may continue to move dangerously. At this time press the “Emergency Stop Switch” to stop the system. It is also possible to stop the system by pressing the two small movement switches simultaneously or pressing one of the switches while also pressing the other switch.

The function of the small movement switch is controlled by the main software. If it malfunctions, turn off and on the key switch.

4.3.5 Bumper Switch

The bumper switch is located at the lower front part of the system. If the bumper switch hits an obstacle, the system will stop. In this case, the system can only be moved backwards.

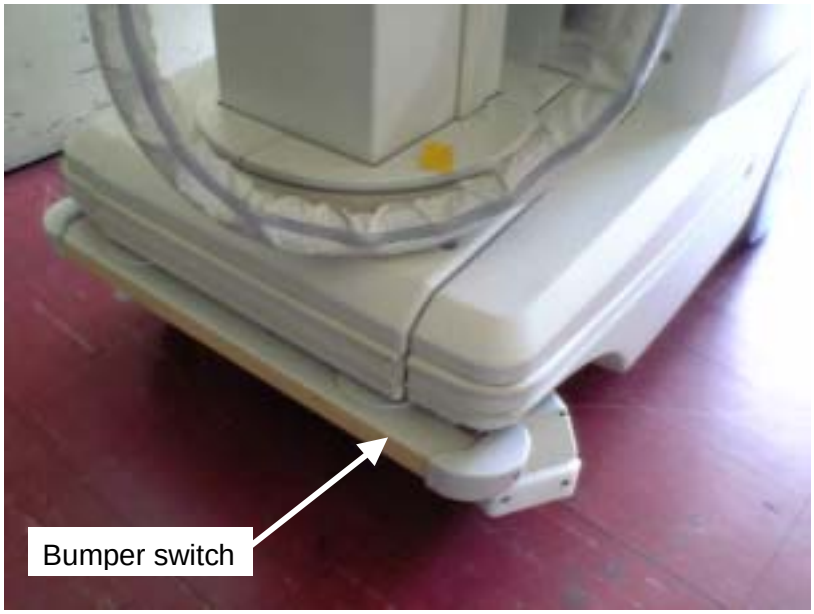


Fig. 4-6 Bumper switch

WARNING

With the “Bumper switch canceling function” enabled, move the system with care, paying special attention to the surroundings. If the system hits any equipment or person, it may damage the equipment or injure the person.

Bumper switch canceling function

If a bumper switch fault occurs, the bumper switch can be temporarily disabled.

To enable this function:

1. Turn the key switch to “OFF” position .
2. Turn the key switch “ON” while pressing the “Collimator lamp” switch .

   At this time the “Battery charge indicator lamp” blinks, indicating the bumper switch is disabled.

"Bumper switch canceling function" is disabled by turning the key switch "OFF" . When recovering this function, execute operation 2.

CAUTION

"Bumper switch canceling function" is only a temporary measure. If the bumper switch does not function normally, do not continue to use the system. Contact your nearest authorized Shimadzu service center.

CAUTION

When using the "bumper switch canceling function", even if the bumper switch is activated, no sound is created.

4.4 Emergency Stop Switch

Pressing the emergency stop switch stops the system.

To release the emergency stop button, turn the emergency stop button in the direction of the arrow. The switch will be released.

Fig. 4-7 Emergency Stop Switch

CAUTION

When releasing the emergency stop switch, watch to see that the system does not make any abnormal movements. If the system moves abnormally, stop using the system and contact your nearest authorized Shimadzu service center.

NOTE

While the emergency stop switch is on, new X-ray exposures can not be made.

4.5 Tube Arm Operations

4.5.1 Tube Arm Lock

"Tube Arm Lock" is the position where the tube arm and the system are coupled at the tube arm joint section.

When making X-ray exposures, release the "Tube Arm Lock" to move the X-ray tube assembly to the filming position. Releasing the "Tube Arm Lock" enables rotation, extension, contraction, and the up and down movements of the tube arm.

WARNING

The system may become unstable if the tube arm is rotated, extended, contracted, or moved up/down while on a slope greater than 5 degrees. Do not release the Tube Arm Lock if the slope is greater than 5 degrees.

How to release the "Tube Arm Lock"

The following three methods are available to release the lock:

- Lift up the X-ray tube assembly while pressing down the "Tube arm lock release switch" on collimator control handle.

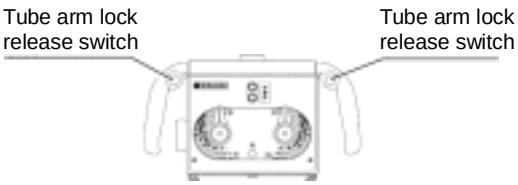


Fig. 4-8 Tube arm lock release switch

- Lift up the X-ray tube assembly while pressing down the "Tube arm lock release lever" that is set at the tube arm joint section.

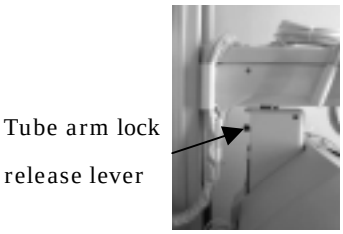


Fig. 4-9 Tube arm lock release lever

- Lift up the X-ray tube assembly while pressing the “Tube arm lock release switch” located on the tube arm.

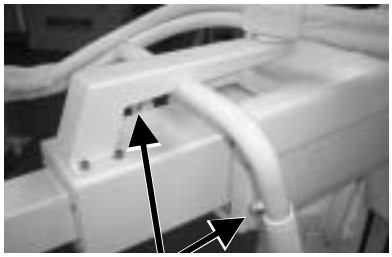


Fig. 4-10 Tube arm lock release switch on tube arm

After the “Tube Arm Lock” has been released, the exposure conditions are displayed on the X-ray control panel, enabling X-ray exposures. (At this time the system is brought into the slow travel mode and the maximum operating speed is limited to approximately half of the normal operating speed.)

How to set the “Tube Arm Lock”

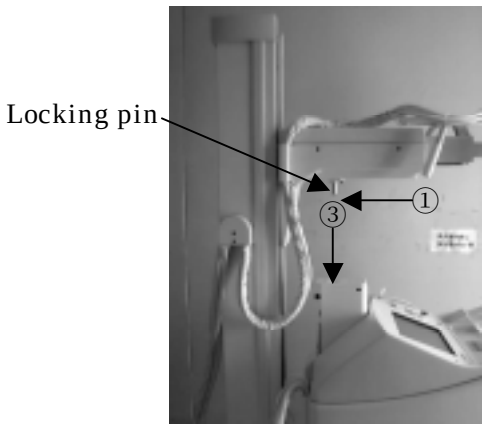


Fig. 4-11 How to set the “Tube Arm Lock”

① Push the X-ray tube assembly in as far as it will go until it hits the stop, while pressing the tube arm lock release switch.

② Return the tilt of the X-ray tube assembly and collimator to the center position.

③ Slowly push down the X-ray tube assembly while pressing the tube arm lock release switch.

④ Insert the locking pin on the lower surface of the tube arm into the locking pin on the tube arm joint section.

⑤ After the locking function has been completed, release the tube arm lock switch, and make sure that the tube arm is secure. Status light will not be illuminated.

After the tube arm has been locked, the system automatically selects the normal travel mode, and the maximum travel speed of the system becomes approximately 5 km/h.

CAUTION

When moving the X-ray tube assembly, be careful that the front of the collimator does not hit the switches on the panel or the panel itself.

CAUTION

Do not place your hand on the cover on the column.
In the up and down movements of the tube arm, parts are moving and you may get injured.

NOTE

When the alarm is locked and the hand switch is pressed, the mAs indicator will show codes F64 and F65. Release the hand switch.

4.5.2 Positioning the X-ray Tube Assembly

The rotated and tilted position of the X-ray tube assembly is held by frictional force. (No switch operations are needed when changing the tilt of the X-ray tube assembly.)

When positioning the X-ray tube assembly, use the angle scale shown in Fig. 4-11 as a guide for rotating the unit around the tube arm axis.

Use the angle scale shown in Fig. 4-12 as a guide for rotating the unit around the tube axis. The knob on the right side is available for fixing / releasing.

When turning the X-ray tube assembly, use the click stops provided every 90 degrees as a guide.

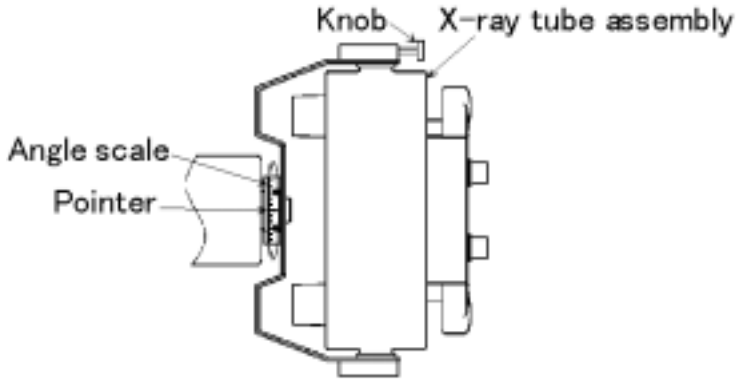


Fig.4-12 Positioning the X-ray tube assembly
(rotation around the tube arm axis)

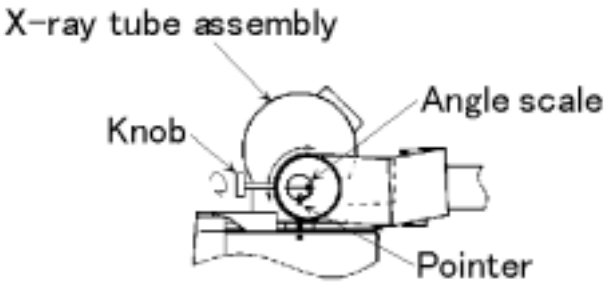


Fig. 4-13 Positioning the X-ray tube assembly (rotation around the tube axis)

CAUTION

Do not rotate the X-ray tube assembly over ±180° or damage may occur to the cable.

4.5.3 Setting the Irradiation Field

How to adjust the irradiation field

When setting the X-ray irradiation field, operate the irradiation field adjusting knob on the front of the collimator. Adjust the size of the irradiation field referring to these two guides:

- The measure attached on the side of the collimator
- The scale printed on the front of the collimator

Collimator Light

The X-ray irradiation field is checked with the light field.

The cross-hair intersection on the light field indicates the center of the X-ray irradiation field.

The collimator lamp switches are located on the front of the collimator, the X-ray control panel, and remote controller (optional). The collimator lamp is turned on by pressing any of the switches. The collimator lamp is automatically turned off after approximately 30 seconds. It is also turned off by pressing the switch once more.

By pressing the exposure hand switch to the first position and then immediately releasing it, the collimator lamp can also be turned “ON” and “OFF”. (Refer to “4.8 User Setting”.)

NOTE

When Ready operation is performed while the collimator lamp is lit, the collimator lamp switches off automatically.
During Ready operation the collimator lamp can not be turned on.
When the collimator lamp is lit after Ready-up, refer to “4.8 User Setting”.

4.5.4 Positioning of X-ray Field and Image Receptor

1. Adjust the distance between Focal Spot and Image Receptor by referring the measure attached on the side of the collimator.
2. Align the cross-hair intersection on the light field with the cross hair of CXDI-50G front cover. The cross hair of front cover shows the center of the Image Receptor.
3. Adjust the X-ray field size on the CXDI-50G front cover by the cross-hair intersection on the light field.

4.6 How to Change Exposure Condition

NOTE

When the DR system's Exposure Mode button is selected, and the corresponding anatomical program is selected, the registered exposure conditions are changed

4.6.1 How to Set Exposure Condition

The exposure conditions of this system are set with X-ray tube voltage and current time product. The maximum X-ray tube current (mA) and the shortest exposure time(s) are automatically derived within the ratings of the system and X-ray tube assembly from the set value of radiographic mAs. The method of changing the exposure conditions are described below:

The X-ray tube voltage (kV) and current time product (mAs) is limited as follows.

Setting of X-ray tube voltage	Setting the mAs
40 kV - 90 kV	0.32 mAs - 320 mAs
91 kV - 100 kV	0.32 mAs - 280 mAs
101 kV - 110 kV	0.32 mAs - 250 mAs
111 kV - 120 kV	0.32 mAs - 220 mAs
121 kV - 125 kV	0.32 mAs - 200 mAs

4.6.2 Manual Setting Method

NOTE

The DR system exposure conditions cannot be changed manually.
When manually setting the exposure conditions refer to the procedure described below:

When exposure conditions register with the anatomical program are changed by the manual setting method, the switch of the filming region, the filming orientations and the body thickness correction blink.

Setting of the radiographic X-ray tube voltage (kV)

The setting value is shown on the radiographic X-ray tube voltage display.

Pressing the switch [+] to increase the X-ray tube voltage in 1-kV increments.

Pressing the switch [−] to decrease the X-ray tube voltage in 1-kV decrements.

Keep [+] or [−] switch pressed to accelerate the change of the setting value.

Setting of the radiographic current time product (mAs)

The set value is shown on the display for the current time product

Pressing the switch [+] increases the product in 1-step increments.

Pressing the switch [−] decreases the product in 1-step decrements.

Keep [+] or [−] switch pressed to accelerate the change of the setting value.

4.6.3 Setting Method with Anatomical Programs

How to select an anatomical program

One of the registered exposure conditions can be selected by operating the switch on the X-ray control panel.

1. Filming regions

   “Head” , “Chest” , “Abdomen” , “Waist” ,
   “Leg” , “Foot” , “Arm” and “Hand”

2. Filming orientations

   “Front” (AP) , “Side” (Lateral) and “Oblique”

3. Body thickness correction

   Select one from:

   “Thin” , “Normal” and “Obese”

   The LED of the selected switch illuminates.

An example of the selection

The case where the examinee has a standard body and the exposure is made on the front (AP) of the Abdomen.

1. Selecting the filming region:	Press [Abdomen] switch	
2. Selecting the filming orientation:	Press [Front] switch	
3. Selecting the body thickness correction:	Press [Normal] switch	

NOTE

For detailed DR system imaging region registration, refer to Canon's CXDI Manual. For anatomical program numbers that correspond to the DR system imaging region, refer to "9.7 Anatomical Program Number"

4.6.4 Registration of Anatomical Programs

Stored contents

The following factors for filming are stored in an anatomical program:

(Refer to "Table 3-1 Description and basic function of each switch".)

- Filming region
- Filming orientation
- Body thickness correction
- Exposure condition
  - X-ray tube voltage
  - Current time product

NOTE

The longest X-ray exposure time of the DR radiography is 1000msec. Registed exposure conditions in the anatomical program used to X-ray exposure by the use of the DR radiography so that the exposure time may become 1000msec or less.

Registration procedures

1. Selections for an anatomical program

   Select the filming region, filming orientation, and body thickness correction to be registered.

2. Setting the exposure condition

   Select the exposure condition to be stored.

3. Make sure that the filming region, filming orientation, body thickness correction, and exposure condition are correctly registered.

4. Press registration switch for approximately 3 seconds.

   During this time the buzzer sounds and the registration switch lamp blinks.

5. Keep pressing the registration switch until APr SEt is shown on the radiographic condition display.

   The indication APr SEt on the radiographic condition display means that the anatomical program has been written.

NOTE

When writing an anatomical program, continue to press the registration switch until APr SEt is shown on the radiographic condition display. (Do not release the registration switch until APr SEt is shown on the radiographic condition display.)

NOTE

After registering anatomical program, confirm that the anatomical program imaging conditions correspond to the DR system's imaging region settings.
For detailed DR system imaging region registration, refer to Canon's CXDI Manual.
For anatomical program numbers that correspond to the DR system imaging region, refer to "9.7 Anatomical Program Number"

4.6.5 Delete of Anatomical Programs

Delete contents

An anatomical program, which is not used, can be deleted.

`------` is the displayed radiographic condition when deleting an anatomical program.

Delete procedures

1. Selections for deleting an anatomical program

   Select the filming region, filming orientation, and body thickness correction to be the non-used anatomical program.

   Please check the anatomical program that it is going to be deleted.

2. Press registration switch and setting mAs [+] for approx. 3 seconds.

   During this time the buzzer sounds and the registration switch lamp blinks.

3. Keep pressing the registration switch and setting mAs [+] until `dEl PtP` is shown on the radiographic condition display.

   The indication `dEl PtP` on the radiographic condition display means that the anatomical program has been deleted.
   `------` is displayed with radiographic condition display.

NOTE

When writing an anatomical program, continue to press the registration switch and setting mAs [+] until `dEl PtP` is shown on the radiographic condition display.
(Do not release the registration switch and setting mAs [+] until `dEl PtP` is shown on the radiographic condition display.)

NOTE

After deleting anatomical program, change the previous anatomical program settings so they match the DR system's imaging region.

How to use the deleted an anatomical program

If a deleted anatomical program is chosen, it will be displayed on an exposure condition display part as ------. Exposure operation cannot be performed.

If the following operations are performed, a deleted anatomical program is made usable and exposure operation can be performed.

Using a deleted anatomical program procedures

1. Choose a deleted anatomical program. It is displayed on an exposure condition display as ------.

2. Exposure tube voltage setting change [+] switch, [-] switch, exposure tube current and time product setting change [+] switch, [-] switch.
   Continue pushing either switch. (For approx. 3 seconds)
   A buzzer sounds at this time.

3. Continue pushing the switch until the display ------ disappears and exposure conditions are displayed.
   Exposure conditions are displayed on the exposure condition display.
   The deleted anatomical program becomes usable, and exposure operations can be performed now.

NOTE

An exposure tube voltage setting change [+] switch, [-] switch and a exposure tube current and time product setting change [+] switch, [-] switch until the display of exposure conditions appears in a exposure condition display. To enable a deleted anatomical program, continue pushing any one switch. (Please do not release the switch until exposure conditions are displayed on a exposure condition display part.)

NOTE

The operator can enable a deleted anatomical program so exposure operation can be performed. (The exposure conditions currently displayed are not memorized by deleting an anatomical program.)

Register an anatomical program to memorize the exposure conditions used this time (an anatomical program is made to memorize exposure conditions).

4.7 Making an X-ray Exposure

NOTE

Before exposure of X-ray irradiation, the X-ray tube unit (called aging times,) and operation are required. Since it is aging with reference to "6.3 Aging of an X-ray tube", please perform X-ray exposure. If aging is inadequate, X-ray tube unit may discharge at the time of X-ray exposure.

NOTE

X-ray exposure can be made only when the “Tube Arm Lock” is released. Before making an exposure, make sure that the “Ready” message appears on Color Touch Panel Display.

NOTE

If the power plug is connected to power outlet, X-ray exposure cannot be made - remove the power plug from the outlet.

NOTE

While the system is moving, X-ray exposure cannot be made. Release your hold on the driving handle bar and small movement switches and then X-ray exposure can be made.

NOTE

During X-ray exposure, if the distance piece attached at the bottom of the collimator is deformed inward, it may enter the irradiation field. If it is, return the distance piece to its normal form.

NOTE

After checking the DR system’s Ready display, perform X-ray imaging. If the DR system’s [Ready] processing is not completed and X-ray exposure is performed, the error “F68” will appear and imaging will not be possible.

NOTE

The longest X-ray exposure time of the FPD radiography is 1000msec. Make a X-ray exposure of GR radiography when the X-ray exposure time exceeds 1000msec.

4.7.1 Archiving an Exposure

1. Start DR system.
   Refer to the canon CXDI manual for the operation of DR system.
2. Press the FPD select switch on the X-ray control panel.
   Holding doen the FPD select switch for 2 seconds or more will change to the FPD device Radiography mode.

NOTE

Select the DR System's Exposure Mode button and General Radiography mode will change to FPD device Radiography mode.
Thereafter selected the appropriate Anatomical Program and change the registered exposure conditions.

3. Press the hand switch button to the first position (exposure preparation switch).
   The preparation for exposure then begins. The operational status indicator lamp will be blinking Green.

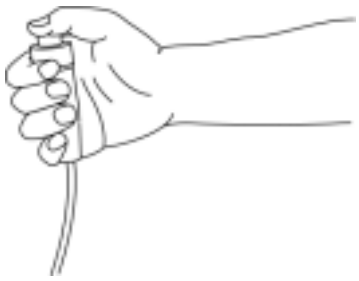


Fig. 4-14 First position of the hand switch

NOTE

The light is not illuminated unless the key is turned off or the tube arm is latched.
Only if the stand-by illuminates, exposure preparation can be made. Confirm that the stand-by illuminates before pushing the hand switch.

NOTE

During preparation, the collimator lamp will turn off automatically.
When preparation has been performed, the collimator lamp will not illuminate until the exposure is complete. If the collimator lamp needs to be turned on, the preparation/exposure button must be released. When the collimator lamp is to be lighted after Ready-up, refer to "4.8 User Setting".

4. Preparation will be completed and Ready indicator lamp will come on. Operational state indicator lamp is Green.

NOTE

If the X-ray exposure is not made within 30 seconds after the handswitch has been pressed to the first position, the preparation will be automatically cancelled.
To prepare an X-ray exposure again, repeat procedure above.

If the Collimator lamp lights after Ready-up, refer to “4.8 User Setting”.

NOTE

After checking the DR system READY display, perform X-ray exposure. If the DR system’s READY processing is not completed and X-ray exposure is performed, the error “F68” will appear and imaging will not be possible.
After checking the DR system’s READY display, press the FPD image selection switch to release the error.

5. After checking the READY display on the touch panel monitor, press the hand switch button to the second position (X-ray exposure switch).
Then, the X-ray will be radiated. Operational state indicator lamp is Orange.

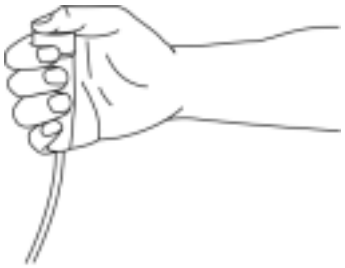


Fig. 4-15 Second position of the hand switch

6. During the X-ray exposure, the X-ray exposure indicator lamp lights and the buzzer sound. Operational state indicator lamp is Orange.
After X-ray irradiation, kV and mAs displays will blink. Operational state indicator lamp blinks until the state of a battery is recovered.

NOTE

Exposure conditions displayed in the X-ray control panel kV, mAs display, and the touch panel monitor might be different.

NOTE

After performing exposure, until the battery is recharged another image can not be taken. Wait until the Stand-by display lights before performing any operations. Depending on the exposure conditions, 1 minute or more may be required.

NOTE

During an X-ray exposure the hand switch must continue to be fully depressed until the exposure finishes. If the switch is released before completion of the exposure, the exposure will be terminated prematurely. In this case the film may not be clear due to insufficient X-ray exposure.
When repeating Ready operation, completely release the hand switch (First and second position) one time.

4.7.2 Thumb Nail Images

After the X-ray irradiation, a thumb nail image will appear in the touch panel monitor. Use this monitor to check for blur caused by patient movement.

NOTE

The touch panel monitor is not designed for diagnostic use.
The image displayed in the touch monitor is for reference use only. Do not use it for diagnostic purposes.

4.7.3 To transfer images from the PC hard drive to either a DICOM Printer, DICOM workstation or to a DICOM PACS system.

CAUTION

Connect the LAN cable to the printer,workstation,PACS and other units which conform to IEC60601-1.
Use of a non-conforming unit can cause a device accident, operation error, smoking, overheating, electric shock, and/or damage or loss of data.

Images saved in the device can be output to a DICOM printer, workstation, PACS or other similar unit.

1. Pull out the LAN cable from the bottom of the drive handle and connect it to the printer or network.
2. Operate the DR system according to Canon's CXDI manual and output the image.

   For detailed information about peripheral units (printers, etc.), be sure to refer to that unit's Operation Manual.

4.7.4 Saving an Image to an External Media

CAUTION

Connect the USB connector to the pripheral units which conform to IEC60601-1.

Connecting a non-conforming unit can result in device damage, operation error, smoking, overheating, electric shock, data loss or damage.

1. Connect a peripheral unit (Hard disk, USB memory or other unit) to the top cover's USB connector.
2. Follow the instructions given in Canon's CXDI manual to operate the DR system and save images.
3. Press Eject Media button on the DR system's Study List and remove the media.
4. Connect the peripheral unit to a printer, workstation or other unit and print out the images.
   For detailed information about external storage media (USB memory, etc.) or peripheral units (printers, etc.), be sure to refer to that media/device's Operation Manual.

4.7.5 Filming Procedures

1. Change the X-ray Control Panel's Film Image mode.
   Holding down the Film Image Selection switch for 2 seconds or more will change to the Film Image mode.

NOTE

Select the DR System'Sthe Exposure Mode button,and change from General Radiography mode will change to FPD device Radiography mode. Thereafter selected the approprate Anatomical Program and shange the registered exposure conditions.

2. Press the hand switch button to the first position (exposure preparation switch).
   The preparation for exposure then begins. The operational status indicator lamp will be blinking Green.

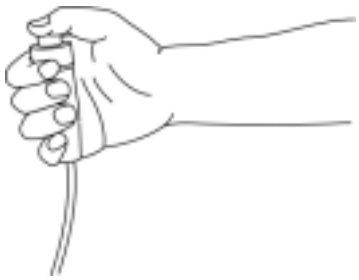


Fig. 4-16 First position of the hand switch

NOTE

The light is not illuminated unless the key is turned off or the tube arm is latched.
Only if the stand by illuminates, exposure preparation can be made. Confirm that the stand by illuminates before pushing the hand switch.

NOTE

During preparation, the collimator lamp will turn off automatically.
When preparation has been performed, the collimator lamp will not illuminate until the exposure is complete. If the collimator lamp needs to be turned on, the preparation/exposure button must be released. When the collimator lamp is to be lighted after Ready-up, refer to “4.9 User Setting”.

3. Preparation will be completed and Ready indicator lamp ○ will come on. Operational state indicator lamp is Green.

NOTE

If the X-ray exposure is not made within 30 seconds after the handswitch has been pressed to the first position, the preparation will be automatically cancelled.
To prepare an X-ray exposure again, repeat procedure above.

If the Collimator lamp lights after Ready up, refer to “4.9 User Setting”.

4. After Ready up indicator lamp has been turned on, press the hand switch button to the second position (X-ray exposure switch).
Then, the X-ray will be radiated. Operational state indicator lamp is Orange.
It is possible to have a loud buzzer sound during exposure. Refer to “4.8 User Setting”.

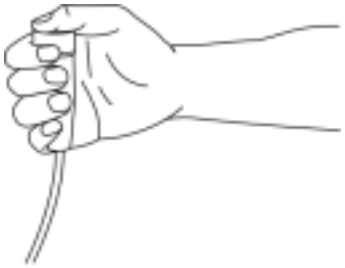


Fig. 4-17 Second position of the hand switch

5. During the X-ray exposure, the X-ray exposure indicator lamp lights and the buzzer sound. Operational state indicator lamp is Orange.
After X-ray irradiation, kV and mAs displays will blink.
Operational state indicator lamp blinks until the state of a battery is recovered.

NOTE

After X-ray exposure, until the battery is recharged another image can not be taken. Wait until the Stand by display lights before performing any operations. Depending on the exposure conditions, 1 minute or more may be required.

NOTE

During an X-ray exposure the hand switch must continue to be fully depressed until the exposure finishes. If the switch is released before completion of the exposure, the exposure will be terminated prematurely. In this case the film may not be clear due to insufficient X-ray exposure.

4.7.6 Acquiring an Image and filming with Insufficient Battery Charge

If the red lamp and the green lamp of the battery indicator are illuminating at same time, battery charging is needed. At this time it will be possible to make X-ray exposures although exposure time may take longer than normal.

NOTE

The longest X-ray exposure time of the FPD device radiography is 1000msec.

4.8 Charging the Battery

NOTE

To charge battery, turn the main breaker “ON” before performing charging.
If the main breaker is “OFF”, charging cannot be performed.
When connecting the power plug, error message F5c will appear. Since the battery is not connected, charging can not be performed. When an error is displayed, after disconnecting the power plug, turn the main breaker “ON”, connect the power plug and charge the battery.

Charging

Pull out the power plug from the front of the system and insert it into a power outlet and switch it on.

The “Power line connection indicator lamp” illminate, and after approximately 10 seconds the battery charging begins. During charging, the “Charging lamp” is turned on and the state of charge is indicated on the battery indicator. (Table 4-2)

NOTE

Recharging cannot be performed while the main breaker is “ON”.
If the DR system is operating, recharging cannot be performed.
If the device’s main key is turned “OFF”, stop the DR system and then perform recharging.

Completion of Charging

After the battery has been fully charged, the charging automatically completion and the “Charging lamp” switches off.

More than 90% charge is achieved in approximately 5 hours if the red lamp was on initially. Full Charge is achieved in approximately 8 hours (maximum 10 hours.)

NOTE

When the amount of useful time decreases, the life of the battery may expire. Batteries should be replaced. Contact your nearest authorized Shimadzu service center.

Table 4-2 Battery charge indicator

Indicator	State of charging
□ ■□□□□ ~ □ ■■■■■	Battery is being charged. Battery is charged approximately 90%.
□ ■■■■■	Battery has been fully charged.

■ shows blink, ■ shows ON, and □ OFF.

CAUTION

When charging the battery, place the system where good ventilation is provided.

CAUTION

When pulling out the power outlet, hold the black portion of the plug and do not apply excessive force to the power cable. Pulling the cable with force may damage the cable or the internal cable reel.
When rewinding the power cable into the cable reel, hold on the power plug until the cable is completely rewound on the reel.

NOTE

The battery can not be charged while the circuit breaker is in “OFF” position. It can be charged when the key switch is in either “ON” or “OFF”, when the main circuit breaker is in the “ON” position.

NOTE

During battery charging, neither X-ray exposure nor moving the system is possible. Turning the key switch “ON” makes it possible only to release the brake.
If the DR system is started, battery charging will stop.
Stop the DR system, turn the device’s key switch “OFF”, and then restart recharging.

NOTE

Charge the battery in the “Use environment” described in “2.3 Use Conditions”. The recommended temperature is 30℃ or less to ensure a long life and good performance of the battery. If the battery is charged at a temperature higher than 40℃, battery life and performance may be reduced.

NOTE

To ensure a long life and good performance of the battery, it is recommended that recharging the battery is done after three or less LEDs of the battery indicator have been turned off. Frequent charging may lower the performance and reduce the battery life. When all the LEDs of the battery remaining charge indicator are turned on, the battery should not be charged to prevent the battery from being over-charged, even if the power lead is connected to a power outlet.

NOTE

To ensure a long life and good performance of the battery, always fully recharge the battery. If the battery charging is terminated early, the charge indicator will not show the true state of the battery charge, because the voltage of the battery has not fully stabilized immediately after charging.

NOTE

When not using the system for a long time, the following precautions reduce potential damage to the battery.

- Charge the battery fully before placing the system in storage.
- Turn “OFF” the main circuit breaker after fully charging.
- Keep the storage temperature between –10℃ and 40℃. (Do not exceed 30℃ if possible).
- During storage, charge the battery at least once every 6 months (in the ambient temperature of 25℃). In higher ambient temperatures reduce the charging intervals by 50%.
- After extended storage periods the battery should be fully discharged (until the red LED lights) and fully recharged several times to restore the battery to its full performance capability.

About the battery charging in the first use of the system after its installation

To stabilize the battery performance, it is recommended to use the system once until the red LED of the charge indicator lights up and then recharge the battery. Repeat this cycle several times.

NOTE

While the unit is being charged, the CXDI software can be used to offload the images.

4.9 User Setting

The power-assist, acceleration, steer control, backward power-assist auto-power-off time, buzzer control, collimator lamp control, APR setting at the time of starting the apparatus, and apparatus ID setting can be changed.

- The power-assist setting can adjust the operational feeling in driving the system.
- The Acceleration setting can adjust the operational feeling in accelerating the system.
- The steer control setting can adjust the operational feeling in stabilizing the system.
- The backward power-assist setting can adjust the operational feeling in back driving the system.
- The auto-power-off time setting can change the setting time of the “Auto-power-off function”.
- The buzzer control setting can select beep the buzzer at x-ray control panel switch operation.

  Also, it is possible to choose whether or not to sound the additional buzzer.
- The collimator lamp control setting can enable or disable the “Setting the Irradiation field” that is operated by the click-operation of the hand switch.

  Also, it is possible to choose whether or not to “light the light field” after the “Ready-up”.
- In APR setting at the time of starting the apparatus, it is possible to set the exposure condition of the APR.
- In apparatus ID setting, it is possible to set each apparatus ID when two or more apparatuses are used.

The methods of setting these items are described below.

4.9.1 Setting and Registering User Settings

When chaging normal mode into user setting mode.

Press down the user setting switch for 3 seconds to change into user setting mode.

After changing to the user setting mode, a display USr oPE appears on the X-ray control panel for approximately one second.

The item to be set is indicated on kV display. It can be charged by pressing kV [+] and kV [−] and kV [+] switch.

kV display	Item
PAS	Power-assist setting
Acc	Acceleration setting
StC	Steer control setting
bAC	Backward power-assist setting
APO	Auto-power-off time setting
bON	Buzzer control setting
LAP	Collimator lamp control setting
aPr	APR setting at the time of starting the apparatus
id	Apparatus ID setting

When returning to the normal mode.

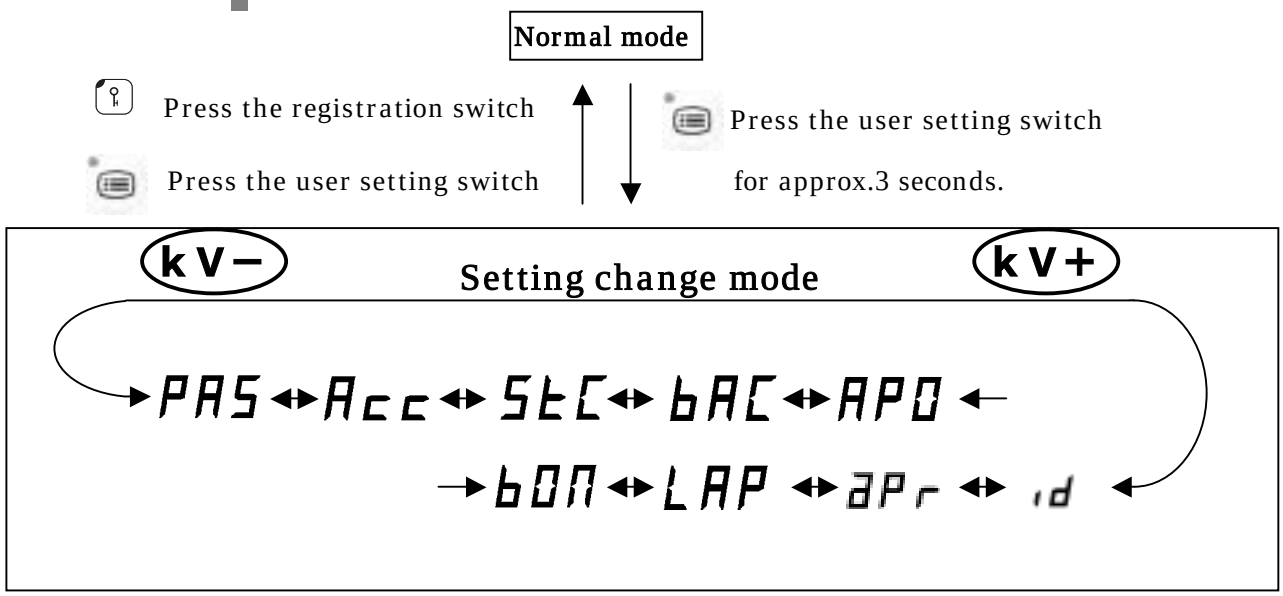

Normal mode
Press the registration switch
Press the user setting switch
Press the user setting switch
for approx.3 seconds.
kV−
Setting change mode
kV+
PAS ↔ Acc ↔ StC ↔ bAC ↔ APO ←
→ bON ↔ LAP ↔ aPr ↔ id

Fig. 4-18 Transition diagram between setting change mode and normal mode

(1) In case of registering changed data

Press the registration switch .
The display appears on the X-ray control panel. The user setting mode returns to the normal mode.

NOTE

It is possible to register new data of plural settings at once.

(2) In case of not registering changed data

Press the user setting switch

4.9.2 Power-assist setting (PAS)

When changing to the user setting mode, the setting value is displayed on mAs display.

When pressing mA [+] and mA [−] switch, the content of item is changed.

Table 4-3 Content of power assist setting

mAs display	Content of power assist setting
100	Light
95	↑
:	↑
75	↑
70	Normal
65	↓
:	↓
35	↓
30	Heavy

This item is set to “70” at the time of delivery.
When the other setting items have been set, press the registration switch to register the new data.
The display record appears on the X-ray control panel. The user setting mode returns to the normal mode.

4.9.3 Acceleration setting (ACC)

When changing to the user setting mode, the setting value is displayed on mAs display.
When pressing mA [+] and mA [−] switch, the content of item is changed.

Table 4-4 Content of acceleration setting

mAs display	Content of acceleration setting
100	Easy to accelerate
95	↑
:	↑
65	↑
60	Normal
55	↓
:	↓
35	↓
30	Slowly to accelerate

This item is set to “60” at the time of delivery.
When the other setting items finished, press the registration switch to register the new data.
The display record appears on the X-ray control panel. The user setting mode returns to the normal mode.

4.9.4 Steer control setting (SEC)

When changing to the user setting mode, the setting value is displayed on mAs display.
When pressing mA [+] and mA [−] switch, the content of item is changed.

Table 4-5 Content of rotatability

mAs display	Content of rotatability
100	Easy turn
95	↑
90	↑
:	↑
:	↓
55	↓
50	Easy straight

This item is set to “100” at the time of delivery.
When the other setting items finished, press the registration switch to register the new data.
The display rEcord appears on the X-ray control panel. The user setting mode returns to the normal mode.

4.9.5 Backward power-assist setting (bAC)

When changing to the user setting mode, the setting value is displayed on mAs display.
When pressing mA [+] and mA [−] switch, the content of item is changed.

Table 4-6 Content of backward movement assist setting

mAs display	Content of backward movement assist setting
100	Light
95	↑
90	↑
:	↓
:	↓
55	↓
50	Heavy

This item is set to “100” at the time of delivery.
When the other setting items finished, press the registration switch to register the new data.
The display rEcord appears on the X-ray control panel. The user setting mode returns to the normal mode.

4.9.6 Auto-power-off time setting (APO)

When changing to the user setting mode, the setting value is displayed on mAs display.

When pressing mA [+] and mA [−] switch, the content of item is changed.

Table 4-7 Content of auto-power-off time setting

mAs display	Content of auto-power-off time setting
--	No setting of auto-power-off
05	5 minutes
10	10 minutes
15	15 minutes
20	20 minutes
30	30 minutes

This item is set to “15” at the time of delivery.

When the other setting items finished, press the registration switch to register the new data.

The display rEGord appears on the X-ray control panel. The user setting mode returns to the normal mode.

4.9.7 Buzzer settings (bON)

The settings are indicated on the mAs indicator.
Indication of the setting is varied by pressing mA [+] and mA [-] switches.

Table 4-8 Contents of buzzer setting

mAs indicator	Content of buzzer setting
on	The buzzer sounds when the switch on the X-ray control panel is pressed. If the bumper switch is activated, the buzzer will sound. (If the bumper cancel feature is activated, the buzzer will not sound.) The high-volume buzzer sounds during exposure.
bEP	The buzzer does not sound during the time when KV [+], [-] or mA [+], [-] switch is being pressed to vary exposure conditions rapidly. If the bumper switch is activated, the buzzer will not sound. The high-volume buzzer does not sound during exposure.
oFF	The buzzer does not sound even if the switch on the X-ray control panel is pressed (except for the cases of registering anatomical programs and changing various settings). If the bumper switch is activated, the buzzer will not sound. The high-volume buzzer does not sound during exposure.

The buzzer is set to “on” at the time of delivery of the apparatus.

If no more settings are required, press the registration switch to register the set contents.

Then, rEcord is indicated on the X-ray control panel, and the operation returns to the normal mode.

4.9.8 Setting collimator lamp control (LAP)

The setting is indicated on mAs indicator.

Pressing mA [+] or mA [-] switch varies the indication of setting as follows:

0-C ⇔ 1-1 ⇔ E-1 ⇔ 0-1 ⇔ 1-C ⇔ E-C ⇔ 0-C

Table4-9 Content of collimator lamp setting

Indication on the hundreds place of mAs	Content
0	After the preparation for exposures has finished, the collimator lamp lights for approximately 10 seconds.
1	The collimator lamp comes off when the preparation for exposures starts. (When the collimator lamp is to be turned on, stop the Ready operation and then put on the collimator lamp.)
E	The preparation for exposures starts while the collimator lamp is lighting. Once the collimator lamp shuts off, and just after the preparation has finished, the collimator lamp lights for approximately 10 seconds.

Indication on the ones place of mAs	Content of collimator lamp setting
C	Enables collimator lamp turned on/off by the click operation of the hand switch.
1	Disables collimator lamp turned on/off by the click operation of the hand switch.

The indication is set to “0-C” at the time of delivery of the apparatus.
If no more settings are required, press the registration switch to register the set contents.
Then, rEcord is indicated on the X-ray control panel, and the operation returns to the normal mode.

4.9.9 Setting APR at the time of starting the apparatus (aPr)

The setting is indicated on mAs indicator.
Pressing mA [+] or mA [-] switch varies indication of the setting.

Table4-10 Content of APR at the time of starting the apparatus

mAs indication	Content of APR at the time of starting the apparatus
0	The exposure condition just before the power supply is turned off is stored and indicated. (When the exposure condition for the APR has been changed manually, the changed condition is indicated.)
1	The exposure condition just before the power supply is turned off is stored and indicated.(When the exposure condition for the APR has been changed manually, the changed condition is not indicated, but the exposure condition stored in the APR is indicated.)
2	Select the APR to be indicated at the time of starting the apparatus on the X-ray control panel. The exposure condition for the selected APR is indicated. The selected LED will light. The selected APR's conditions will be displayed at start-up.

The indicator is set to "0" at the time of delivery of the apparatus.

If no more settings are required, press the registration switch to register the set contents.

Then, record is indicated on the X-ray control panel, and the operation returns to the normal mode.

4.9.10 Setting apparatus ID (id)

The setting is indicated on mAs indicator.

Pressing mA [+] or mA [-] switch varies indication of the setting from 0 to 99.

Table 4-11 Content of apparatus ID

mAs indication	Content of apparatus ID
0←→99	Apparatus ID

The indicator is set to "0" at the time of delivery of the apparatus.

If no more settings are required, press the registration switch to register the set contents.

Then, record is indicated on the X-ray control panel, and the operation returns to the normal mode.

4.10 Emergency Brake Release Function

This device is equipped with an emergency brake release function that is designed to release the device's brake in the event of an emergency, such as device movement problems, etc.

4.10.1 How to activate the emergency brake release function

Turn off the key switch on the power supply panel, and remove the key. Insert the removed key into the switch for activating the emergency brake release function on the front panel of the main unit, and turn on the switch. Then, the emergency brake release function will be activated.

CAUTION

Do not turn on the switch for activating the emergency brake release function except for cases of emergency.

When the emergency brake release function is activated, the brake release lever on the running handle is disabled. Also, the power assist will not operate, because the power supply switch is off.

4.10.2 Releasing the emergency brake

The emergency brake is released by pressing the emergency brake release switch which is mounted on the left of the running handle section.

CAUTION

Do not use the emergency brake release switch except for case of emergency.

CAUTION

When using the emergency brake release switch, be especially cautious about the tilt of the floor. Be sure to operate the emergency brake release switch only in emergencies.

No Text

Chapter 5

Options

Chapter Contents

5.1 Remote Controller

5.2 Protective Screen

5.3 Optional Grid

5.4 Dose Area Meter

5.1 Remote Controller

Infrared remote controller can operate the X-ray exposure and collimator.

NOTE

The remote controller is operated by infrared radiation. When making exposures with the remote controller, make sure that other devices are not being remotely controlled in the room.
Also, make sure that bright lights such as examination lamps are not directly striking the photo-receptor.

How to operate the system using the remote controller

1. Press the "Remote controller switch" on the X-ray control panel to turn on the LED.

2. Press the "Exposure preparation switch" ① while aiming the remote controller at the remote controller receiver. Operational state indicator light is blinking Green.

3. Press down the "Exposure preparation switch" ①, and wait until the "Exposure preparation lamp" is turned on.

   After a while the "Exposure preparation lamp" on the X-ray control panel illuminates and the preparation for the exposure finishes. Operational state indicator light is Green.

NOTE

When the DR system is used to exposure, after checking the DR system Ready display, perform X-ray exposure. If the DR system's [Ready] processing is not completed and X-ray exposure is performed, the error "F68" will appear and imaging will not be possible.

4. Press the "Exposure switch" ② while pressing the "Exposure preparation switch" ①.

   Then, the X-ray exposure will be made. Operational state indicator light is Orange.

Table 5-1 Names and basic functions of the remote controller switches

Key	Name	Normal function
①	Exposure preparation switch	Starts the preparation for exposures.
②	Exposure switch	Pressing this switch ① together with the exposure preparation switch radiates X-ray.
③	Collimator lamp switch	Switches between "ON" and "OFF" of the collimator lamp.
④	Transmitting state indicator	When the remote controller is in transmitting mode, the red LED lights up.

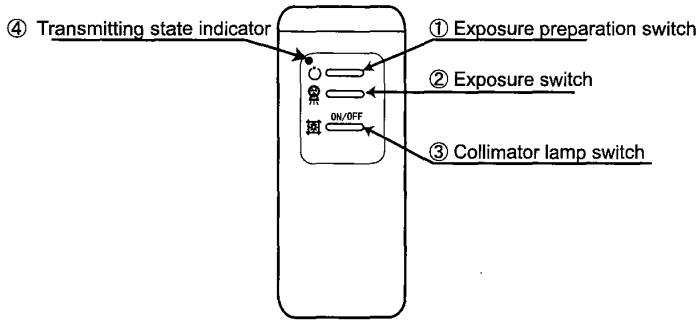


Fig. 5-1 Remote Controller

The remote controller operation is automatically cancelled for safety and the LED of the “Remote controller” switches off, after an exposure with the remote controller has been finished. When making another exposure, press the “Remote controller” switch and turn on the LED.

CAUTION

If the red LED of the “Transmitting state indicator” is illuminating without pressing the switch of the remote controller, the “Remote controller” is in failure. Stop using the remote controller, remove the battery, and contact your nearest authorized Shimadzu service center.

NOTE

If X-ray exposure is made while the lamp of the “Remote” controller switch is illuminating, the lamp extincts and the “Remote” controller is disabled.

NOTE

Until exposure is finished, keep aiming the remote controller transmitter at the receiver.

NOTE

If the red lamp of the remote controller transmitter does not illuminate even with pressing the remote controller transmitter key, exchange the battery of the remote controller.

Operable range of the remote controller

The remote controller is operable around the remote controller receiver within the range of 270 degrees and a radius of 5m.

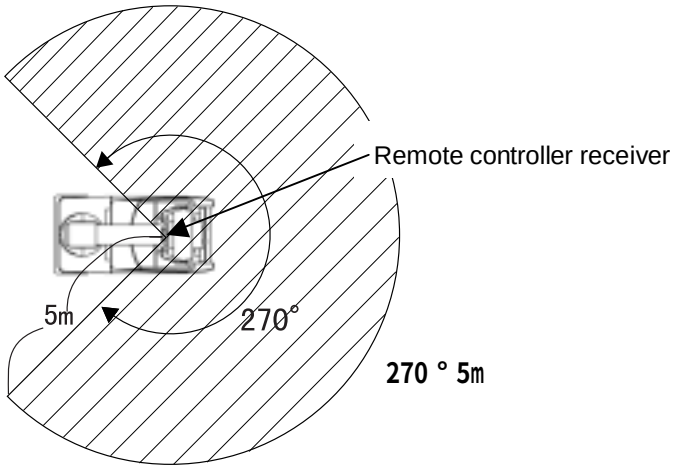


Fig. 5-2 Operable rage of the remote controller

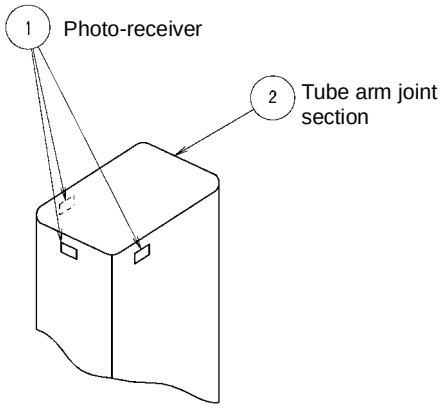


Fig. 5-3 Remote controller photo-receiver

NOTE

The operable range of the remote controller may be affected by surrounding condition.

How to exchange the batteries

1. Slide the battery cover on the back of the remote controller in the arrow direction, and remove the cover.
2. Exchange the old batteries to new size AA batteries (2 cells).
3. Fix the battery cover to the remote controller.

5.2 Protective Screen

Use of the Protective Screen will reduce exposure to radiation.
The specifications of this protective unit are shown in Table 5-2.

Table 5-2 Specifications of the folding-type protective screen

Type	Spigot type
Lead contained acrylic	Lead equivalent at least 0.3mm led or more
Dimensions (using state)	38cm (Vertical)×46cm (horizontal)×0.85cm (thick)
Weight	2.2kg

NOTE

If the protective screen is dropped, it may be damaged. Be sure to handle this screen carefully at all times.

Before X-ray operation, put Protective Screen into Rail on Arm lock joint section.

NOTE

Do not set Protective Screen on the Support stand while operating. If the Protective Screen is set ,Tube Arm hits the Protective Screen. Protective Screen can be stored in the bin while operating the Support stand.

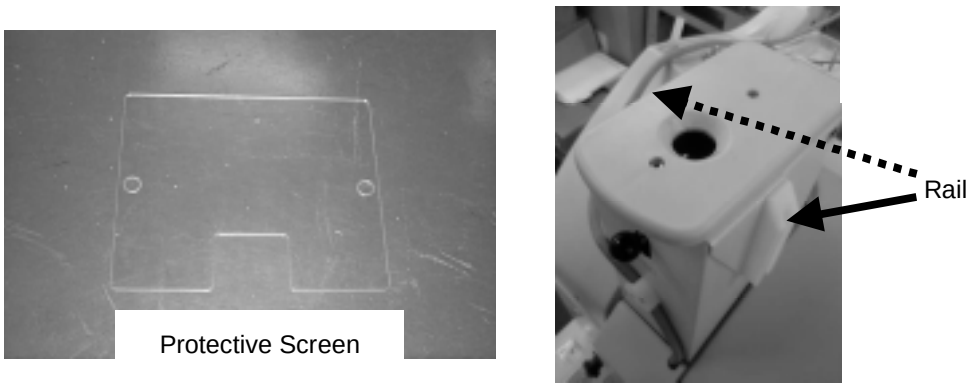


Fig. 5-4 Protective screen option

After X-ray operation, take Protective Screen off Rail on Arm lock joint section.

NOTE

Do not set Protective Screen while driving the system.
Protective Screen can be stored in the bin while driving the system.

5.3 Optional Grid

The optional Grid frame snaps onto the 50G FPD.

Fig. 5-5 Optional grid

For detailed information about attaching and detaching the grid unit, refer to the CANON CXDI's manual.

NOTE

When the grid unit is not being used, store it in the strage bin's far-side slot.

5.4 Dose Area Meter

CAUTION

Because of the risk of damage to the Dose Area Meter, the transparent electrodes of the measuring chamber must not be subjected to mechanical pressure.

The Dose Area Meter is optionally attached on the front of Collimator R-20C.

The Dose Area Meter measures the dose area product and displays the dose area product.

The Dose area meter can be operated when the arm lock has been released and the power lead is disconnected from the power supply.

The Dose area meter is a highly sensitive detector. After application of the chamber voltage, it needs 3 minutes to form and stabilize before the performance characteristics specified in the data sheet are met. This time is called stabilization time.

The measuring system is ready for measurements before this time has elapsed.

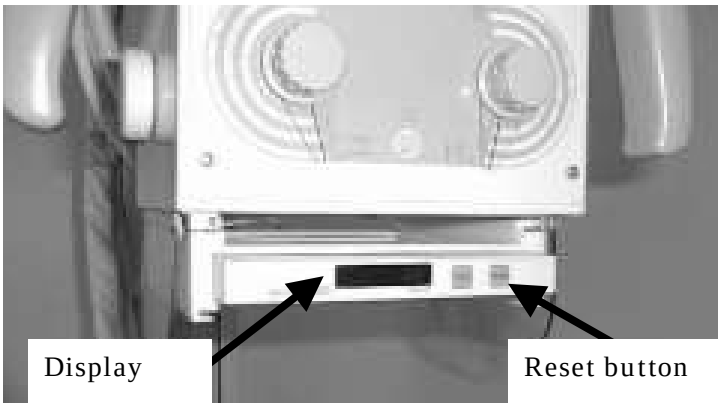


Fig. 5-6 Dose area meter

Table 5-3 Names and basic functions of the dose area meter

Name	Function
Reset button	The dose area meter reset and measuring dose area product.
Display	Display of dose area product.

How to operate the system using the remote controller

1. X-ray tube assembly is put on the X-ray exposure position.

2. The reset button of the dose area meter is pushed. The display of the display part becomes 0, and the measurement preparation of the dose area product is completed.

NOTE

If you measure the amount of the dose area product, push the reset button. Push the reset button can be considered to be the START signal for the measurement of dose area product. Pushed the reset button is recommended to be called up before any measurement.

3. X-ray is irradiation.

4. The dose area product display in the display part of the dose area meter is confirmed.

Cleaning

Cleaning the measuring chamber with a cloth soaked in water with a mild washing-up liquid added is possible.

CAUTION

Do not use scouring or solvent-containing cleansing agents (e.g. benzine, alcohol, stain-remover) or organic solvents for cleaning the measuring chamber.
Using such agents may result in damage to the conductive layers on the electrodes or in reducing the transparency of the ionization chamber.

NOTE

While cleaning, make sure no moisture gets into the ionization chamber. The chamber must be dry before starting the system again..

NOTE

Clean the keypad by wiping it with cloth soaked in a disinfectant.

Chapter 6

Maintenance and Inspection

Chapter Contents

6.1 Inspection

6.2 Cleaning

6.3 Aging X-ray Tubes

6.4 Expendable Parts List

6.1 Inspection

Daily inspection

Before using the system, check the following items. If any abnormal or doubtful points are found, immediately contact your nearest authorized Shimadzu service center.

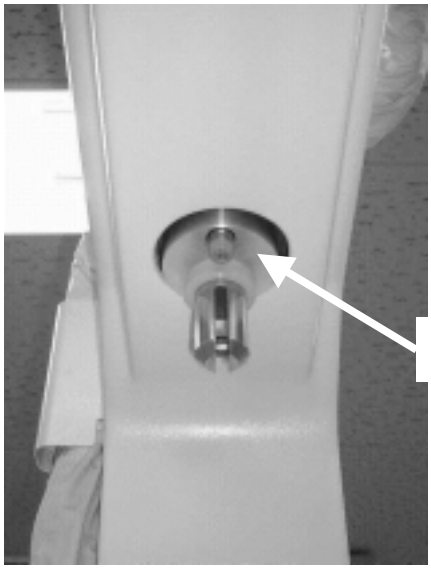
Table 6-1 Daily check items

Item	Check point	Remark
Appearance	Any damage (physical damage) to the cover?	
Wheels and their surroundings	Any abnormal vibrations or sounds occurring while driving the unit. Any physical damage to the front wheels?	
Driving handle	Any unusual looseness?	
X-ray Tube Support stand	Any abnormal sound occurring during rotation or signs of physical misalignment or damage?	
Tube arm	Any scratches or abnormal sounds occurring during up/down movement and expansion/ contraction? Can the tube arm couple to the locking section without undue stress?	
Catch Section	Is the top plate loose? Does it rattle or make noise?	
Arm catch	Any unusual looseness?	
X-ray Tube holder	Any loose parts?	
Collimator and its attachments	Are the collimator and handle bars fixed correctly?	
X-ray control panel	Any flicker or abnormal display?	
HT Cables and other cables	Any twisting or physical damage of the outer insulation?	
Counterbalance Wire	1) Any strand of the rope frayed or damaged? 2) Any corrosion?*	Refer to “Periodical inspection” on the next page.
Bumper Bumper switch	Do you operate normally? Any loose parts? Is the cover correctly attached? Does the bumper switch operate normally?	
Catcher part	Any unusual looseness to the top plate?	
Earth belt	1) Does it appear (look) normal? 2) Is any debris attached to the belt?	Remove dust, when dust has adhered to the belt.

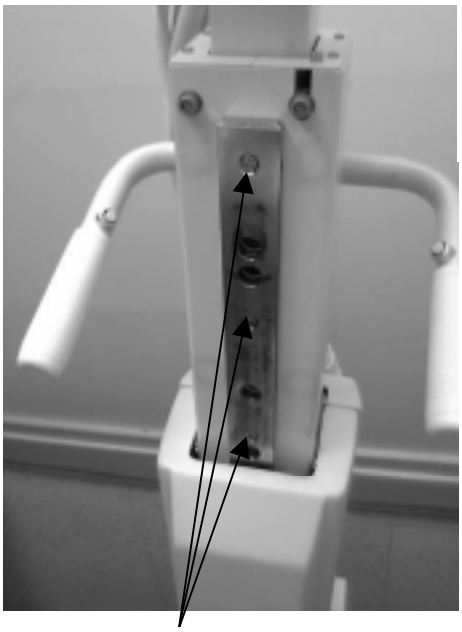
Power plug	Is there any gap between the plug and the stopper? Are any of the plug's prongs bent or deformed?	
Cord reel	Is anything caught in it and making noise? Is the cable cover cut or frayed?	
FPD box fan vent holes	Is dust collected on the vents? Is air being exhausted normally from the vents?	
Others	Any presence of unusual smells or abnormal sounds when the power is turned on or while the battery is being charged? Any abnormal sound or vibration coming from the X-ray tube assembly?	

Tube arm

Immediately contact your nearest authorized Shimadzu service center when the arm connection part shakes.
Whether the M6 bolts in four places loosen



Immediately contact your nearest authorized Shimadzu service center when there is shaking in the movement before and behind the arm is loose.
There is a possibility that the M5 bolts in five places in which the rail under an inside arm is installed.
Confirm whether the bolts in three places loosen when the arm is extended to the maximum.

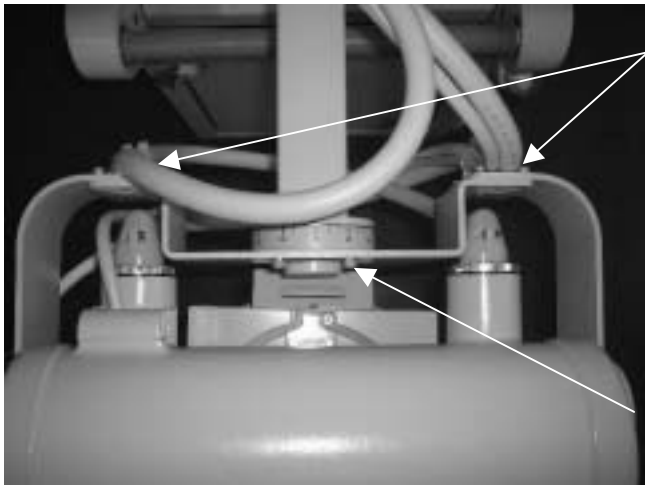


M5 bolts (five places)

The bolts in two places are hidden by the cover.

X-ray Tube holder

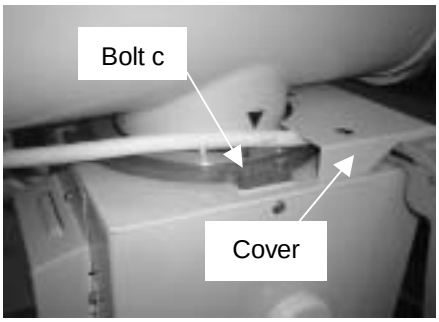
Immediately contact your nearest authorized Shimadzu service center when the X-ray tube holder shakes.
Whether the M5 bolts in four places loosen respectively



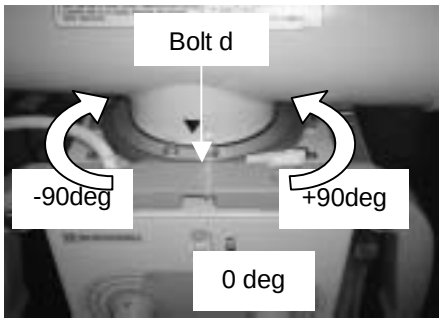
Collimator and its attachments

Immediately contact your nearest authorized Shimadzu service center when the collimator shakes.
Whether the bolts in four places loosen.
Standard position of collimator (0 deg)
_____Bolt a is confirmed.
+90deg rotation of collimator _____Bolt b is confirmed.
-90deg rotation of collimator _____Bolt c is confirmed.

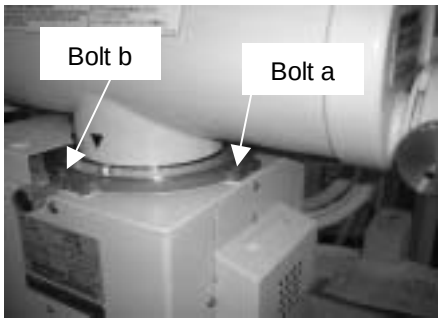
There is a possibility that bolt d is loose while bolts a-c are loose, also.



Left side



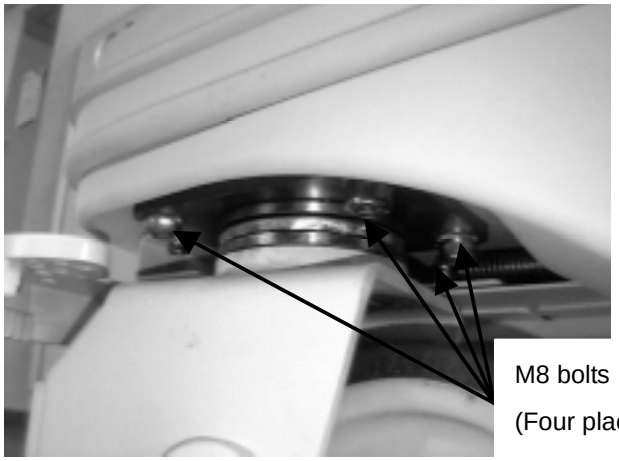
The front
(State to remove cover)



Left side and the rear side

Wheels and their surrounding

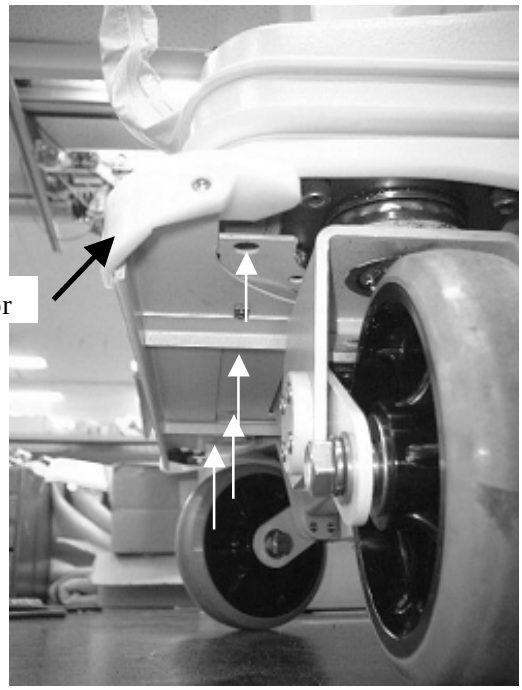
Immediately contact your nearest authorized Shimadzu service center when the front wheel attaching portion shakes.
Whether the M8 bolts in four places loosen respectively.



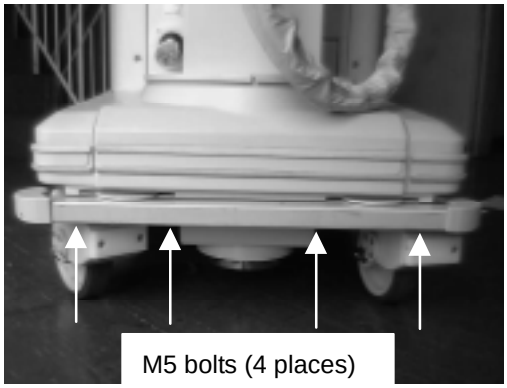
M8 bolts
(Four places respectively)

Bumper

Immediately contact your nearest authorized Shimadzu service center when the bumper shakes. Whether the M5 bolts in four places loosen. The bumper should deflect and spring back into position freely.



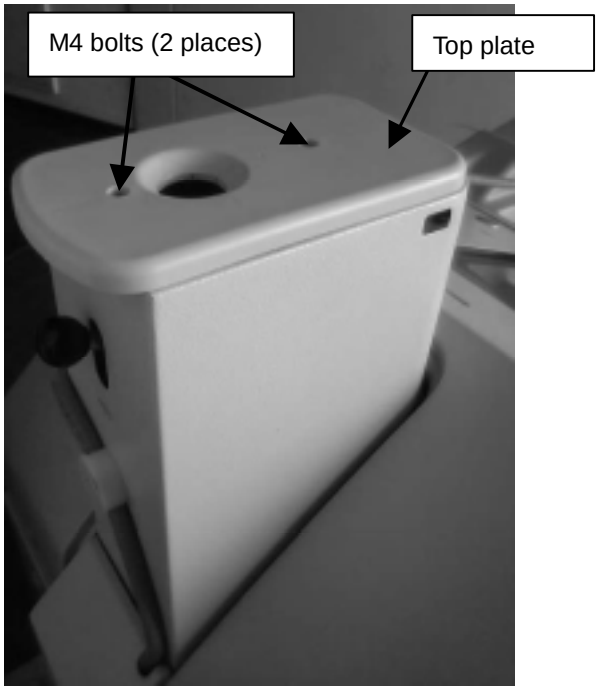
Cover protector



M5 bolts (4 places)

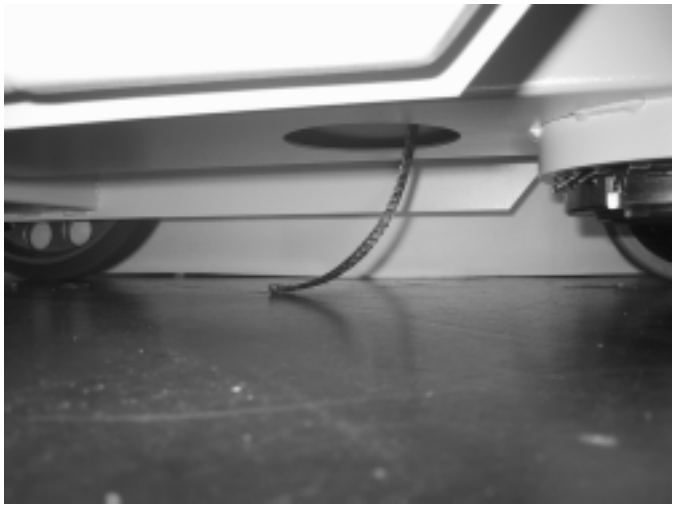
Catcher part

Immediately contact your nearest authorized Shimadzu service center when the top plate in the catcher part shakes.
Confirm whether the M4 bolts in two places loosen



Earth belt

Confirm whether the Earth belt touches the floor and is free of dirt, dust and hair.
Keep clean the earth belt.
If any abnormal or doubtful points are found, immediately contact your nearest authorized Shimadzu service center.



Power plug

Check that the power plug and the stopper are securely attached, with no gaps between them.
Check that the plug's prongs not bent or deformed.
Check that the cable cover is not cut or frayed.
Check that the power supply is supplying the correct level of power.

If any abnormal or doubtful points are found, immediately contact your nearest authorized Shimadzu service center.

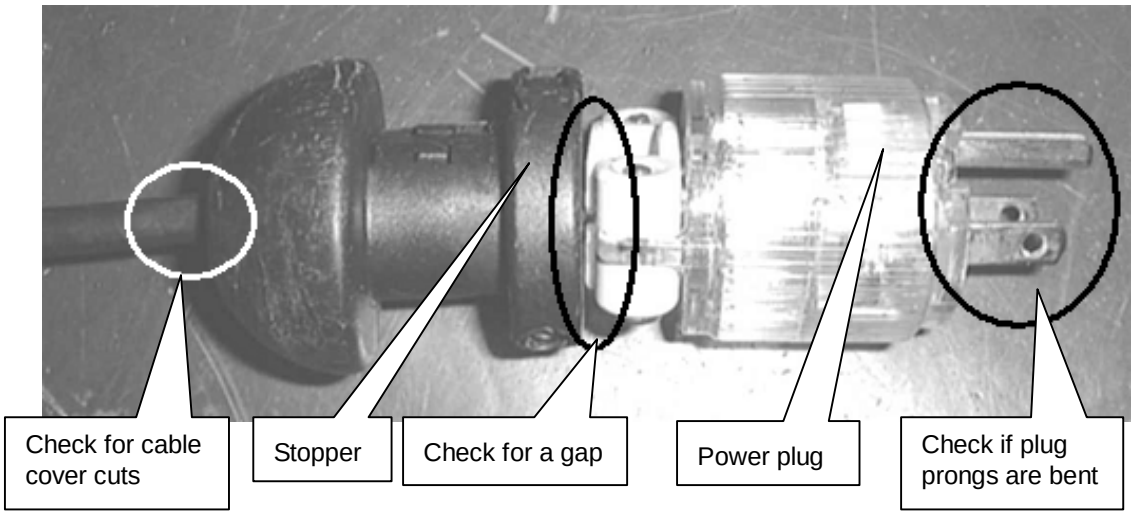


Fig. 6-9 Power plug

Cord reel

Check if the cable cover is cut or frayed.
Check if anything is catching the reel and making noise when the cable is pulled out or when it is retracted.

If any abnormal or doubtful points are found, immediately contact your nearest authorized Shimadzu service center.

Periodical inspection

Even if any anomalies are not found during the daily inspections, your nearest authorized Shimadzu service center should check the following items. It is recommended to carry out the periodic check every 6 months.

Table 6-2 Periodical check items

Item	Check point	Remark
Support stand	Check all fixing bolts and screws	
Battery	1) Appearance? 2) Correct voltage?	*2
Power supply	Output voltage normal?	
X-ray output	Check X-ray tube voltage and mAs.	
Wire rope	1) Any frayed or broken strands? 2) Is the fixing point normal? 3) Is the rope lubricated? 4) Any deformation or corrosion?*	*1
X-ray tube rotation	Is the rotation lubricated?	
Arm catch	Check storage. 1) Are you fixed? 2) Any unusual looseness? 3) Confirmation of storage signal	
Tube arm	Any scratches or abnormal sound occurring during up/down movement?	
Bumper	Do you operate normally? Any loose parts?	
Earth belt	Does the belt touch the floor?	Remove dust, when dust has adhered to the belt.
DC motor	The key to the motor shakes, and it is loose is confirmed.	
FPD Bin	Are support cushions obstructed?	
Grid holder	Is not the part where the grid case is installed transformed?	
Cable	Any twisting or damage to the cable?	
Power plug	Is there any gap between the plug and the stopper? Are any of the plug's prongs bent or deformed?	
Cord reel	Is the cable cover cut or frayed? Is anything caught in it and making noise?	
Collimator	Is irradiation field adjusting knob's operation normally?	

*1 The wire rope must be replaced at least every 10 years from the date of original equipment delivery. Contact your nearest authorized Shimadzu service center for the necessary replacement.

Shimadzu part number 503-46520-01 2 pieces

*2 The batteries are recommended to be replaced every 2 years. Contact your nearest authorized Shimadzu service center for the necessary replacement. Replace batteries when a fully charged set of batteries have a reduced operational life.

Shimadzu part number 074-71031-02 20 pieces

DC motor

Check if there is any looseness or slack in the motor's key.

(Checking procedure)

1. Remove the wheel cover.
2. Unscrew the motor's outside screw, and remove the round cover. (Fig 6-10)

Fig. 6-10 Motor outside cover removed

3. Check if there is any looseness or slack in the motor's key shown in Fig. 6.10.

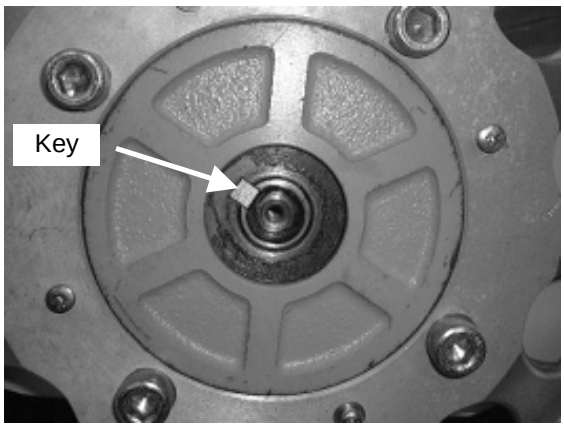


Fig. 6-11 Enlarged view of key

6.2 Cleaning

If the system is soiled, wipe the surfaces with a cloth dampened with an antibacterial or antiseptic solution.

CAUTION

This system is not protected against inflow of liquids. When cleaning the equipment , be careful not to let any liquids flow under the covers.

NOTE

Never use organic solvents such as paint thinner except medical alcohol. Medical alcohol for cleaning causes no problems.

If film-developing solution or fixing solution adheres, it will cause iscoloration. Wipe off these solutions immediately with a damp cloth.

6.3 Aging X-ray Tubes

When using an X-ray tube for the first time, a running-in operation called aging is required. Perform this aging in any of the following methods. When perform the aging, close the collimator leaf.

CAUTION

If X-ray exposure is performed without aging, there is a possibility that X-ray tube unit may cause electric discharge. Since it is aging every day, please perform X-ray exposure.

1. When using an X-ray tube assembly for the first time that day: ➡ **Go to Aging 1**

2. When the X-ray tube assembly uses a tube voltage of more than 100 kV ➡ **Go to Aging 2**

NOTE

Perform aging every day if the X-ray tube assembly is used with a tube voltage of more than 100 kV.

3. After the X-ray tube assembly has been used with a tube voltage of less than 80 kV, and then when it is to be used with a voltage of more than 100 kV ➡ **Go to Aging 2**

Aging 1

Perform exposures successively from Step 1 to the Step for the X-ray tube voltage to be actually used according to "Table 6-3 Aging procedures". If anything abnormal occurs, then go back 2 steps and perform an exposure there.

Aging 2

Perform exposures successively from Step 3 to the Step with the X-ray tube voltage to be actually used according to "Table 6-3 Aging procedures". If anything abnormal occurs, go back by 2 steps and perform an exposure there.

Table 6-3 Aging Procedures

Step	X-ray tube voltage (kV)	Current time product (mAs)	Times	Pause time (seconds)
1	60	10	2	40
2	70	10	2	40
3	80	10	2	40
4	90	10	2	40
5	100	10	2	40
6	110	10	2	40
7	115	10	2	40
8	120	10	2	40
9	125	10	2	40

6.4 Expendable Parts List

Expendable Parts are shown as Table. 1. Use specified parts at the part replacement.

Table. 1. Expendable Parts List

Parts Number	Parts Name	Rating	Recommended exchange cycle. (Year)
074-71014-01	Battery	*1	2
503-46520-01	Wire Rope	For MUX-100D	10
503-46520-03	Wire Rope	For MUX-100DJ	
511-37058	Wheel,ZP-W1		2
511-37075	Caster,439S-150		2
503-49045	Code reel		2
511-70147	Code reel (LAN)		2
501-78646	CPU backup battery		3
062-65003-02	Collimator lamp		1
503-34889-02	Earth belt		2
036-11143-21	Oring, 4D ss-060		5
072-06033-08	Fuse F1 (On INVERTER UNIT-MUX board)	100A, 600V Slow blow	1
072-01664-34	Fuse F13 (On CONTROL UNIT MUX chassis)	6.3A, 250V Slow blow	
072-01664-15	Fuse F11,F12,F23 (On CONTROL UNIT MUX chassis) Fuse F1 (On MUX CHARGE-04A board) Fuse F6 (On MUX POWER-99 board)	0.5A, 250V Slow blow	
072-01664-26	Fuse F1,F2(On MUX POWER-99 board) Fuse F21,F22 (On CONTROL UNIT MUX chassis)	2.0A, 250V Slow blow	
072-01664-33	Fuse F3,F7,F8 (On MUX POWER-99 board) Fuse F1 (On MUX CHARGE-04B board)	5.0A, 250V Slow blow	
072-01659-83	Fuse F4,F5 (On MUX POWER-99 board)	10A, 250V Slow blow	
072-01665-34	Fuse F9 (On MUX POWER-99 board)	10A,250V Slow blow	
532-23029	Silicon packing (standard plug for the high-voltage unit)	3 mm thick 2 mm thick packing: 532-23061	1
511-15061-11	Contact pin for replacement (standard plug for the high-voltage unit)	Contact pin + tool	1
511-15061-13	Mini plug maintenance kit (mini plug for the X-ray tube unit)	Silicon rubber jacket: 5 pcs Silicon washer: 5 pcs Silicon oil: 5 pcs	1

***1 The parts number 074-71014-01 is for 1piece of battery. 20 pieces are needed when replacing batteries.**

No Text

Chapter 7

Self-Diagnostic Functions

Chapter Contents

7.1 Warning Indication Lamp

7.2 Fault Indication Lamp

7.3 CXDI 6.0 Operation Manual

7.1 Warning Indication Lamp

In the following conditions, the warning indication lamp ⚠ illuminates up, disabling X-ray exposures. The content of the warning is indicated with its code on the mAs display.

When the warning code of Table 7-1 appears, the X-ray exposure cannot be made.

Table 7-1 Contents of the warning codes (X-ray filming is impossible)

Code	Content of warning
H1	With the set exposure condition, the heat accumulated on the anode of the X-ray tube is over tolerance. Reduce the exposure condition, or stop exposures until this warning code disappears.
H2	The heat accumulated on the anode of the X-ray tube has reached its tolerance limit. Stop exposures until this warning code disappears.
H4	The temperature of X-ray tube assembly is too high. Stop exposures until this warning code disappears.
F64, F65	It is an invalid hand switch input. Please release a hand switch. (Please do not push a hand switch.)
F68	The X-ray exposure operation had been done before the ready preparation of the DR system was completed. (Exposure operation can be performed after the ready preparation of the DR system was completed.)
F6d	The emergency switch has been pressed. Resolve the problem of the system.
F76	Anatomical program number doesn't correspond to anatomical code.
E	The battery for CPU memory backup needs replacing now. Contact you're nearest authorized Shimadzu service center.
EEE	The life of the battery for CPU memory backup has expired. Contact you're nearest authorized Shimadzu service center.
bbb	X-ray exposures cannot be made because the battery voltage has dropped. Charge the battery.

- Code H1 to H4 automatically disappears when X-ray tube assembly has cooled down and the temperature has been lowered.
- Codes F64 and F65 disappears when the button of a hand switch is released.
- Codes F68 disappears when the pushed on sheet key FPD switch.
- Code F6d disappears when the emergency stop switch is once turned in the direction of the arrow and then allowed to reset.
- Code F76 disappears when anatomical program number correspond to anatomical code.

- When the memory backup battery needs replacing, the warning lamp illuminates for 3 seconds after the X-ray tube has been released, and code E or EEE appears on the mAs display. Although this code disappears after 3 seconds, the memory backup battery needs replacing. For the replacement contact you're nearest authorized Shimadzu service center.

When the warning code of Table 7-2 appears, travelling the unit will not be possible, only X-ray filming is possible.

Table 7-2 Contents of the fault codes (X-ray filming is possible)

Code	Content of fault
d0 to d3	The running circuit is at fault.
d4 to d11	The control circuit is at fault.

- If the key switch is turned on when the switch or lever has been turned on, code d4 to d11 appears. Release the switch or lever.

For detailed DR system's Error, refer to Canons CXDI manual.

7.2 Fault Indication Lamp

If the self-diagnostic function detects any fault of the unit, the fault indication lamp lights, disabling X-ray exposures. The content of the fault is indicated with its code on the mAs display.

If the fault indication lamp lights, turn off the power by turning the key switch to "OFF", and then turn it "ON" to turn on the power again.

CAUTION

If the power is turned OFF and then ON again the fault indication lamp lights, it indicates a continuing device fault has occurred. When this occurs, do not operate the device.
Also, if the power is turned OFF and then ON again the fault indication lamp goes out, but later repeatedly lights 2 or 3 times, do not operate the device.
In the case of these types of faults, immediately turn the device's power OFF and contact your nearest Shimadzu service representative.

Table 7-3 Contents of the fault codes

Code	Content of fault
F01, F02	The supply voltage is out of its normal range.
F03	The power supply circuit in the system is at fault.
F1*	The X-ray tube voltage control is at fault.
F14	The X-ray tube device was arcing. Do the aging of the X-ray tube device. (Refer to "6.3 Aging of X-ray tube".)
F2*	The X-ray tube current control is at fault.
F3*	The filament heating control is at fault.
F5*	The battery and charging control is at fault.
F5C	The power plug had been connected when main breaker is turned off. (Refer to "4.* Charging".)
F61	The starter is at fault.
F62	The exposure unit is at fault.
F6E, F6F	The irradiation control is at fault.

The mark * indicates a number from 0 to 9 or an alphabet from a to f.

For DR system error information, refer to Canon's CXDI Manual.

7.3 CXDI Operation Manual

See the CXDI Operator's Manual for any fault that may occur on the Acquisition System.

No Text

Chapter 8

Others

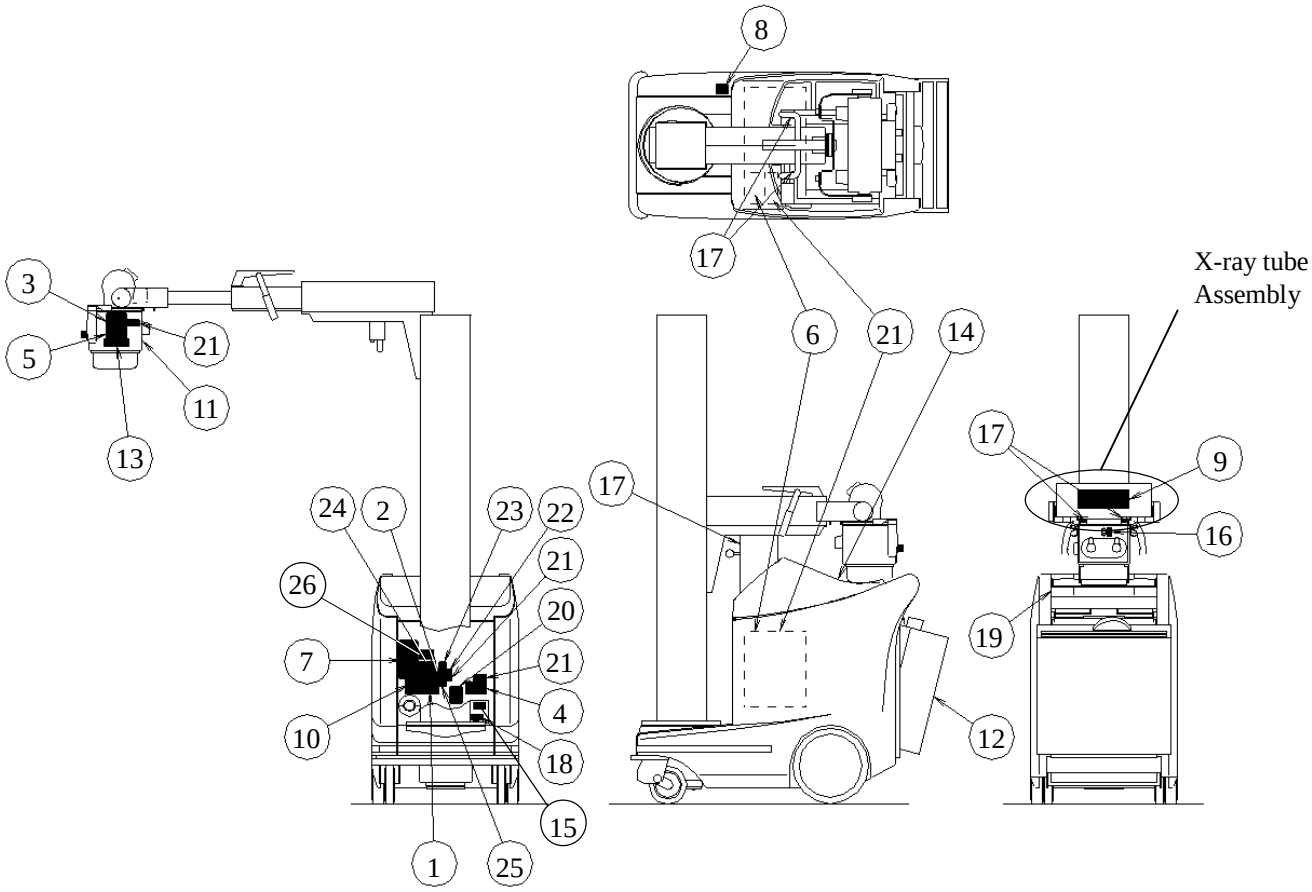
Chapter Contents

8.1 Name plate and labels

8.2 Regulatory Information

8.1 Name plate and labels

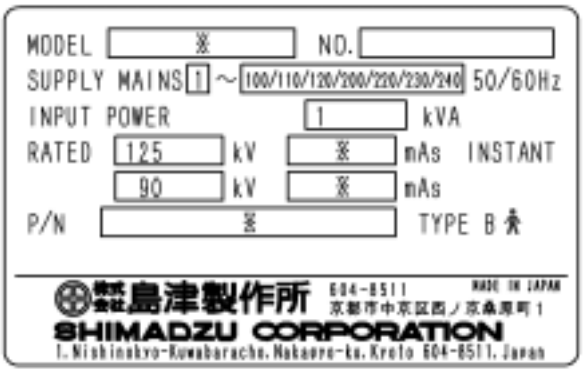
Locations where the labels are attached are shown as follows.



Name Plates

(1) Name plates of MUX-100D, MUX-100DJ

① Name Plate A

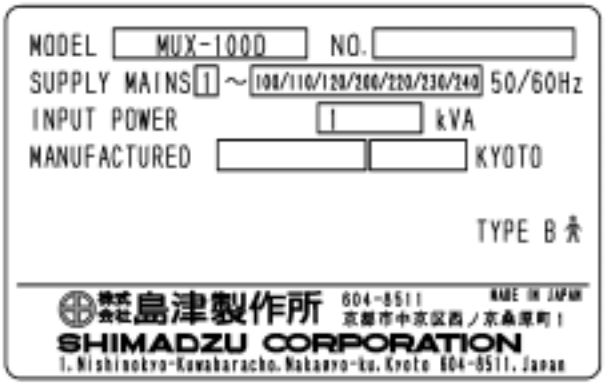

MODEL ※ NO.
SUPPLY MAINS 1 ~ 100/110/120/200/220/230/240 50/60Hz
INPUT POWER 1 kVA
RATED 125 kV ※ mAs INSTANT
90 kV ※ mAs
P/N ※ TYPE B
株式会社島津製作所 604-8511 MADE IN JAPAN
京都市中京区西ノ京桑原町1
SHIMADZU CORPORATION
1, Nishinokyo-Kuwaharacho, Nakagyo-ku, Kyoto 604-8511, Japan

※

MODEL	RATED mAs		P/N	REMARK
	125KV	90KV		
MUX-100D	200	320	503-61000-01	————
			503-61000-02	CE Version
			503-61000-03	UL Version
MUX-100DJ	200	320	503-61000-04	————

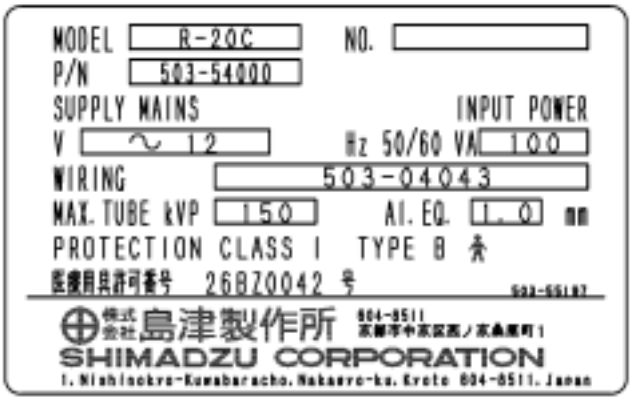
(2) Identification label

② Identification label (UL Version Only)



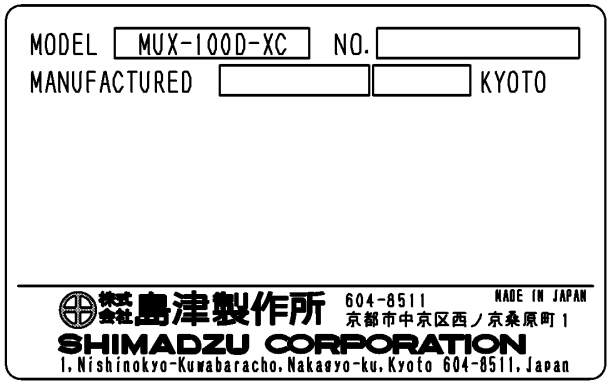
(3) Name plates of R-20C

③ Name plate B

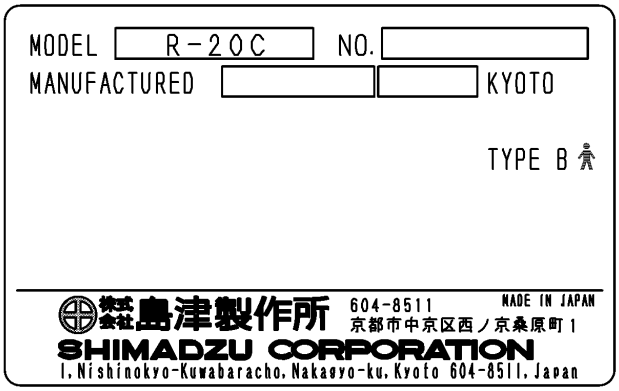


(4) Identification label (UL Version Only)

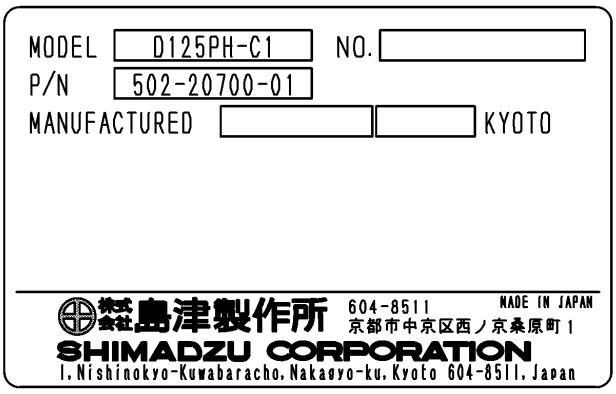
④ Identification label of MUX-100D-XC



⑤ Identification label of R-20C



⑥ Identification label of D125PH-C1



Warning Labels

⑦ Caution Label A

⑧ Caution Label B

⑨ Caution Label C

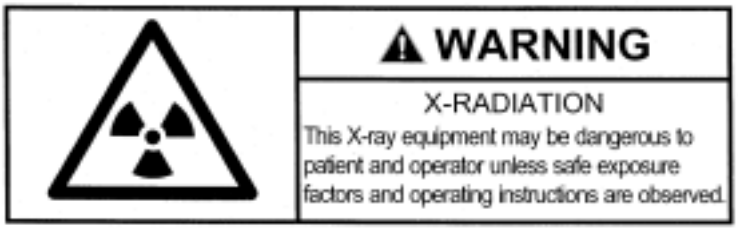
CAUTION
WHEN OPERATING X-RAY TUBE ASSEMBLY IN LOW POSITION,
TAKE CARE THAT ARM DOES NOT HIT MAIN BODY.
RETRACT ARM AND PLACE IN LOCKED POSITION ANY TIME
CART IS DRIVEN. DO NOT RELEASE ARM FROM LOCKED
POSITION ON A SURFACE SLOPING GREATER THAN 5 DEGREES.
LOCK ARM SURELY ACCORDING TO FOLLOWING PROCEDURE.
FINGERS MIGHT BE PINCHED AND INJURED WITH COLLIMATOR
AND DRIVING HANDLE WHEN ARM IS NOT SURELY LOCKED.
1. PLACE TRANSVERSE ARM IN FULLY RETRACTED POSITION.
2. ROTATE AND CENTER COLLIMATOR.
3. PARK TUBE ARM IN DOWN, LOCKED TRANSPORTATION POSITION.
4. CONFIRM ARM IS IN LOCKED POSITION FOR PROPER
DRIVE FUNCTIONS.

⑩ Caution Label D

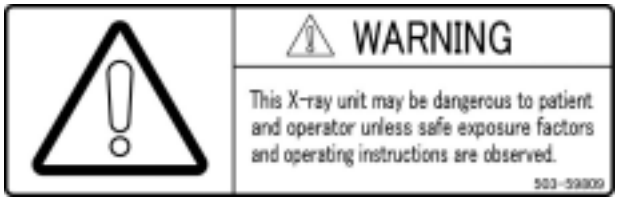
⑪ Caution Label E

⑫ Caution Label F

⑬ Warning label A


WARNING
X-RADIATION
This X-ray equipment may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.

⑭ Warning label B


WARNING
This X-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.
503-59800

⑮ Caution label of breaker

CAUTION
DO NOT TURN 'OFF' THE MAIN CIRCUIT BREAKER WHEN THE DR SYSTEM IS RUNNING.
DRシステムが動作中は、メインブレーカをOFFにしないでください。
503-63395

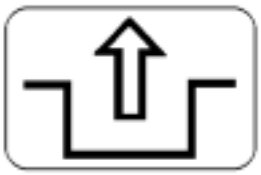
Indication Labels

⑯ Small Movement Switch Label

⑰ Brake Release Switch Label

⑱ Additional Earthing Wire Label

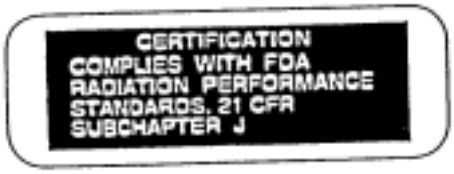
⑲ Label



⑳ Label

Other Labels

(21) Certification Label (UL Version Only)



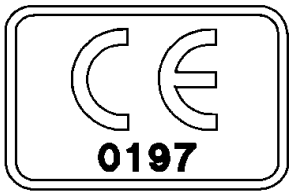
(22) Label EMC

(23) Label TÜV USA (UL Version Only)

(24) EU Representative Label (CE Version Only)

EU Regional Representative:
SHIMADZU DEUTSCHLAND GmbH
Albert-Hahn-Strasse 6-101 D-47269
Duisburg , F.R.Germany
541-42787

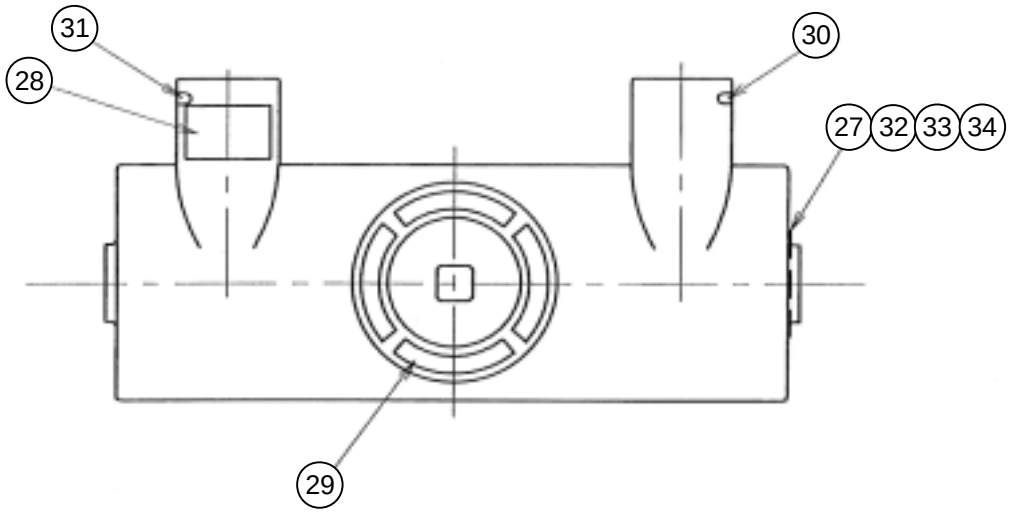
(25) CE Label (CE Version Only)



(26) CE Label (CE Version Only)

Labeling For X-ray tube Assembly

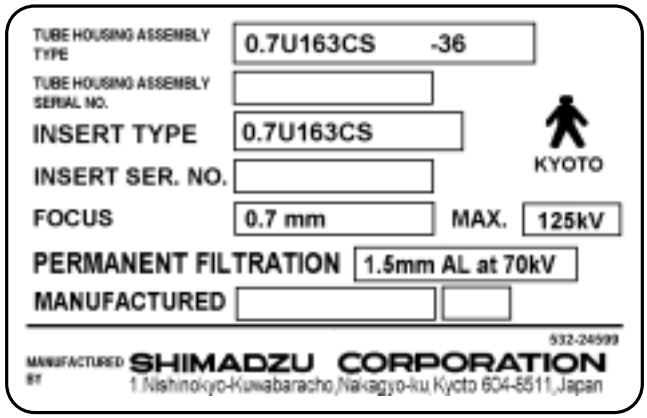
Location Where the Labels Are Attached On:
(X-ray Tube Assembly 0.7U163CS-36)



Note Plates

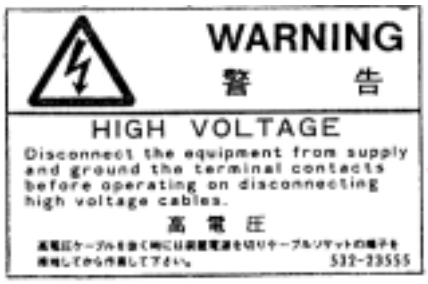
Name plates B Vof rotating-anode X-ray tube assembly

(27) Shimadzu Corporation



Warning Labels

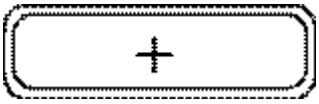
(28) Warning Label (High Voltage)


WARNING
警 告
HIGH VOLTAGE
Disconnect the equipment from supply and ground the terminal contacts before operating on disconnecting high voltage cables.
高 電 圧
532-23555

(29) Label around a radiation gate

Indication Labels

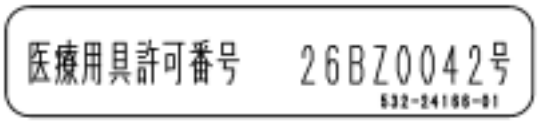
(30) Indication Label " + " (PLUS)



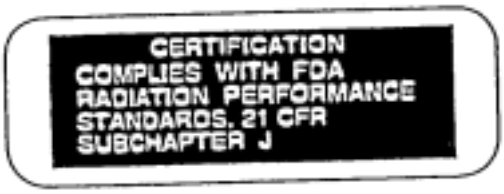
(31) Indication Label " - " (MINUS)

Other Labels

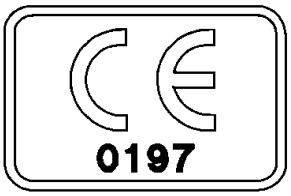
(32) Recognition Number Label
(By The Ministry Of Health And Welfare Of Japan)



(33) Certification Label (UL Version Only)

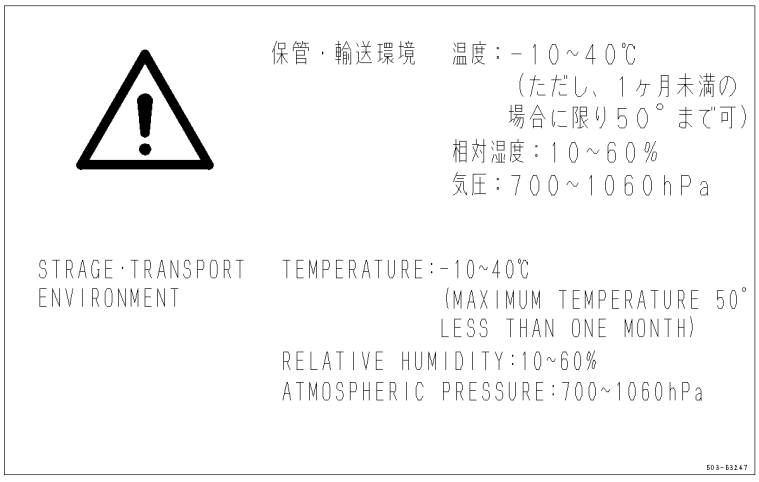


(34) CE Label (CE Version Only)



Package for Transport

Label that is described about storage environment and transport environment on package for transport is shown.



8.2 Regulatory Information （For Europe）

The MUX-100D, MUX-100DJ complies with the requirements of the Medical Device Directive 93/42EEC.

- Product Name : Mobile X-ray System
- Model Name : MUX-100D, MUX-100DJ
- Manufacturer : SHIMADZU CORPORATION
  Medical System Division
- Address : Nishinokyo-Kuwabaracho,
  Nakagyou-ku, KYOTO,604-8511,Japan
- Authorized Representative : SHIMADZU DEUTSHLAND GmbH
- Address : Albert-Hahn-Strasse 6-10,
  D-47269, Duisburg,F.R.Germany

Chapter 9

Specifications

Chapter Contents

9.1 Specifications

9.2 Dimensional Drawing of the System

9.3 X-ray Reference Axis and Focal Spot Position

9.4 Exposure Condition

9.5 Imaging Unit

9.6 Grid (Option)

9.7 Anatomical Program Number

9.1 Specifications

		MUX-100D	MUX-100DJ
Use environment			
	Atmospheric pressure	700～1060hPa	
	Ambient temperature	10～35℃	
	Relative humidity	30～75%	
Common specifications			
	Total width	580mm	
	Total length	1250mm	
	Height of support stand	1930mm	1780mm
	Weight	394kg (with imaging unit)	
	Maximum running speed	5±0.5km/h(this may vary depending on the floor condition.)	
	Imaging unit storage	1 Imaging unit	
	Focus height	600～2010mm	600～1860mm
	Arm length	635～1200mm	
	Support stand rotation range	±270deg.	
	Tube rotation angle	±180deg	
	Tube rotation around tube axis	Forward: 90 deg.; Backward: 20 deg.	
	Minimum distances between Focal Spot and Image Receptor	312mm	
Power supply			
For battery drive:	Supply voltage	Built-in battery	
	Battery type	Shielded lead storage battery (12 V×20 cells)	
For battery charge:	Rating of power supply	1kVA	
	Supply voltage	Single phase AC 100,110,120,200,220,230,240V	
	Supply Impedance	Single phase AC 100,110,120 V : No more than 1.0Ω Single phase AC 200,220,230,240 V : No more than 4.0Ω	
	Supply frequency	50/60Hz	
	Earth resistance	Earth terminal : No more than 100Ω Additional earth terminal : No more than 100Ω	
Power cable length		4m	

			MUX-100D	MUX-100DJ
High-voltage generator				
Nominal electric power			12.5kW (100kV、125mA、0.1s) (The product of the current allowed to flow for 0.1 seconds at a tube voltage of 100 kV and tube voltage)	
Ratings	The nominal maximum tube voltage and the maximum tube current allowed to flow at the nominal maximum tube voltage		125kV、100mA	
	The maximum tube current and the maximum tube voltage that allows the maximum tube current to flow		160mA、 80kV	
	The combination of the tube voltage and tube current that output the maximum electrical power		125kV、100mA 100kV、125mA 80kV、160mA	
	The minimum value of the current time product		0.32mAs	
	The maximum value of the current time product		320mAs	
	The minimum value of nominal irradiation time		3.2 ms	
The current time product that can be set with the X-ray tube voltage	In case of GR radiography.	40～90kV	0.32～320mAs	
		91～100kV	0.32～280mAs	
		101～110kV	0.32～250mAs	
		111～120kV	0.32～220mAs	
		121～125kV	0.32～200mAs	
	In case of FPD device radiography.	40～60kV	0.32～160mAs	
		61～80kV	0.32～125mAs	
		81～100kV	0.32～100mAs	
		101～125kV	0.32～80mAs	
	In case of FPD device radiography (at low level battery).	40～55kV	0.32～160mAs	
		56～65kV	0.32～125mAs	
		66～80kV	0.32～100mAs	
		81～100kV	0.32～80mAs	
		101～120kV	0.32～63mAs	
		121～125kV	0.32～50mAs	
Setting and display of tube voltage for exposure		Range of the setting:	40～125kV、in 1-kV increments	
		Display:	Digital display	
Accuracy		X-ray tube voltage	Less than 10%	
Setting and display of radiographic current time product.		Range of the setting:	0.32，0.36，0.40，0.45，0.50，0.56，0.63，0.71，0.80，0.90，1.0，1.1，1.2，1.4，1.6，1.8，2.0，2.2，2.5，2.8，3.2，3.6，4.0，4.5，5.0，5.6，6.3，7.1，8.0，9.0，10，11，12，14，16，18，20，22，25，28，32，36，40，45，50，56，63，71，80，90，100，110，125，140，160，180，200，220，250，280，320mAs	
		Display:	Digital display	
Accuracy		X-ray tube current time product	Less than 10%+0.2mAs	
Anatomical program			Up to 72 kinds of anatomical programs can be stored. (72 kinds = 8 body parts × 3 orientations × 3 body thickness) The contents of anatomical program stored in memory are: (a) Exposure condition (kV, mAs) (b) Method of exposure	

		MUX-100D	MUX-100DJ
Collimator		R-20C	
Field	Shape	Rectangular	
	Max. field	430 × 430 mm SID 1m	
	Min. field	0 × 0mm (leaves overlapped)	
Light field	Average illumination	> 160 lx	
	Contrast ratio of edge	> 3	
	Accuracy	2% of SID	
	Display of center	Cross lines	
	Type of lamp	Halogen lamp (12V, 100W), #55939	
	Illuminating period	30 seconds, with automatic turn-off time switch	
Field size indication	SID indicated	1, 1.5, 2 m	
	Dimensions indicated	20(8), 23(9), 25(10), 28(11), 30(12), 36(14), 43(17) cm(in.)	
	Accuracy of SID indication	5%	
Drive of leaves		manual	
Mounting dimension (Focus to fit surface distance)		56 mm	
External dimension (W × D × H)		202 × 211 × 200 mm	

X-ray tube Assembly*

Model Name		0.7U163CS-36
Spot size		0.7mm
Target angle		16deg
Nominal X-ray tube Voltage	Radiography	125kV
X-ray tube Assembly	Max. Heat	750kJ(1060kHU)
	Max. Continuous heat dissipation rate	120W(170HU/s)
X-ray Tube	Max. Anode heat dissipation rate	212kJ(300kHU)
	Max. Anode heat dissipation rate	800W(1130HU/s)
	Max. Continuous heat dissipation rate	210W(300HU/s)
	Weight	13kg

Battery

Type	Small sized value regulated lead-acid battery
Specification	12V
Quantity	20 pieces

Minimum specific filtration

Total	2.5 mm Al 70 kV
X-ray tube assembly	Equivalent to 1.5 mm Al 70 kV
Multi-leaf collimator	Equivalent to 1.0 mm Al 70 kV

Classification of the system

Method of protection against electric shock	Class I (only during charging) Internal powered (during powered by internal battery)
Degree of protection against electric shock	Type-B
Classification according to operation mode	Continuous operation with intermittent load

*For detail about X-ray-tube assembly, please refer to X-ray tube operation manual (M535-E219).

CXDI-50G

CXDI-50G is containing mainly three componets;

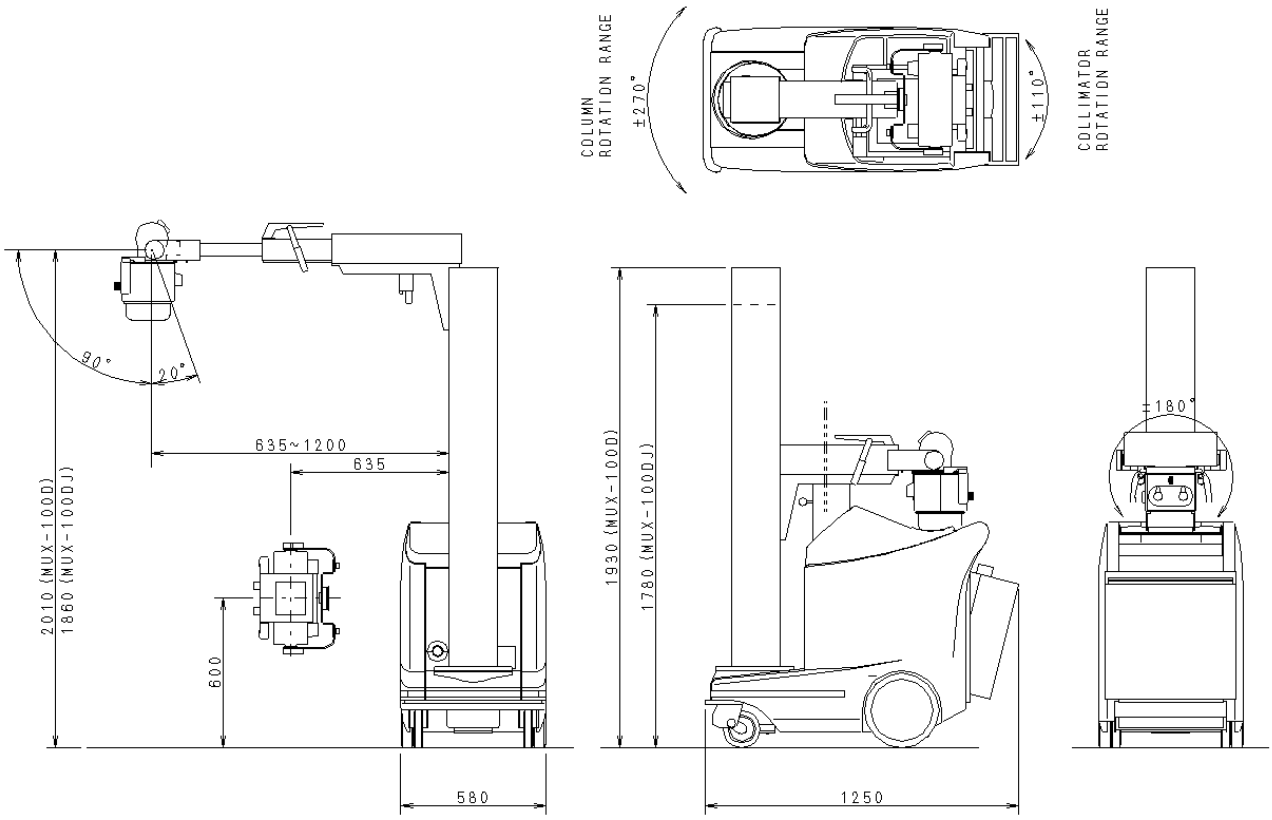
- Imaging unit; Digital Cassette that has the mobility and can be used on the optional angles
- Power box; Power supply and data gateway for imaging unit mounted in the MUX-100D.
- CXDI ; Digital Radiography Operation System for CXDI-50G, installed in Control PC and controled with Touch panel monitor on the MUX-100D.

Imaging unit	MUX-100D	MUX-100D
Effective range	35x 43 cm	
Effective Number of Pixels	2208 x2688	
Pixel Pitch	160μm x 160μm	
Imaging Unit mass	4.8kg (except Grid)	
Mechanical strength	Load uniformly: 150kg Load partly: 100kg/ϕ40mm	
Maximum irradiation time	1000msec	
Mass	4.8 kg (Except cable)	
Dimension	491(W) x 477(D) x 23(H)mm with operation grip	
Grayscale	12bit (4,096 grayscale)	
Option		
Grid	Snaps onto the Imaging unit. Attenuation equivalent : 2,3mmAl.eq.	

For detail about CXDI, please refer to CXDI series operation manual (Canon CXDI Digital Radiography).

Options	MUX-100D	MUX-100DJ
Remote controller	Infrared type Ready operation, X-ray operation, Collimator lamp ON/OFF	
Removable X-ray protective screen	Removable X-ray protective acrylic screen	
Dose Area Meter	Dose Area Meter	

9.2 Dimensional Drawing of the System



9.3 X-ray Reference Axis and Focal Spot Position

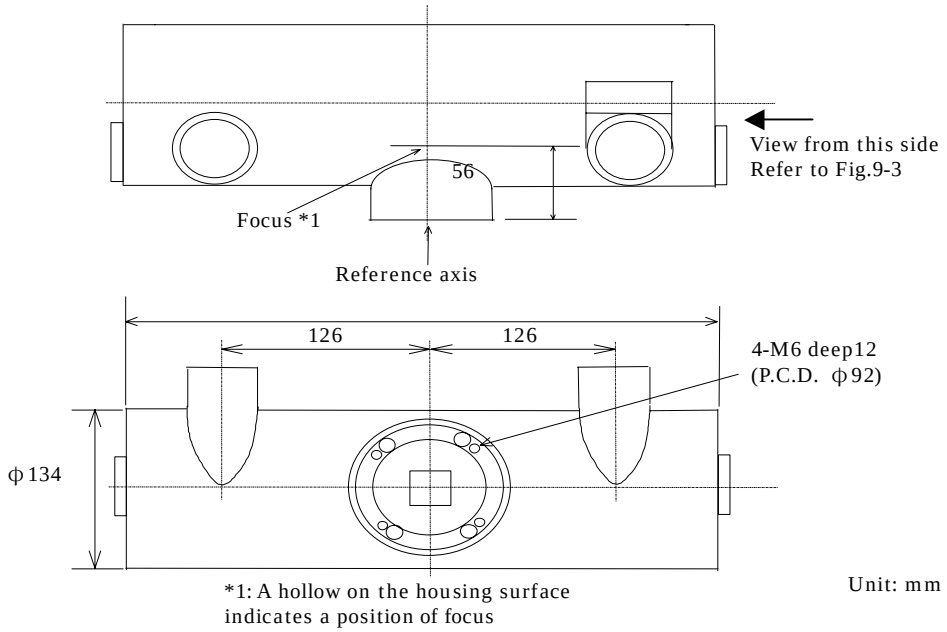


Fig. 9-2 X-ray reference axis and focal spot position (front and upper view)

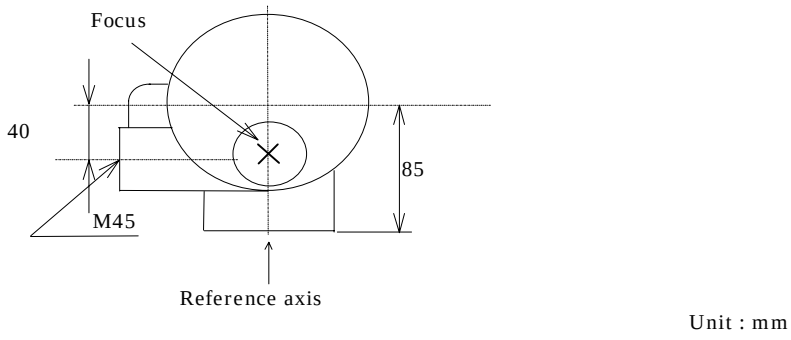


Fig. 9.3 X-ray reference axis and focal spot position (Side view)

9.4 Exposure Condition

MUX-100D/100DJ

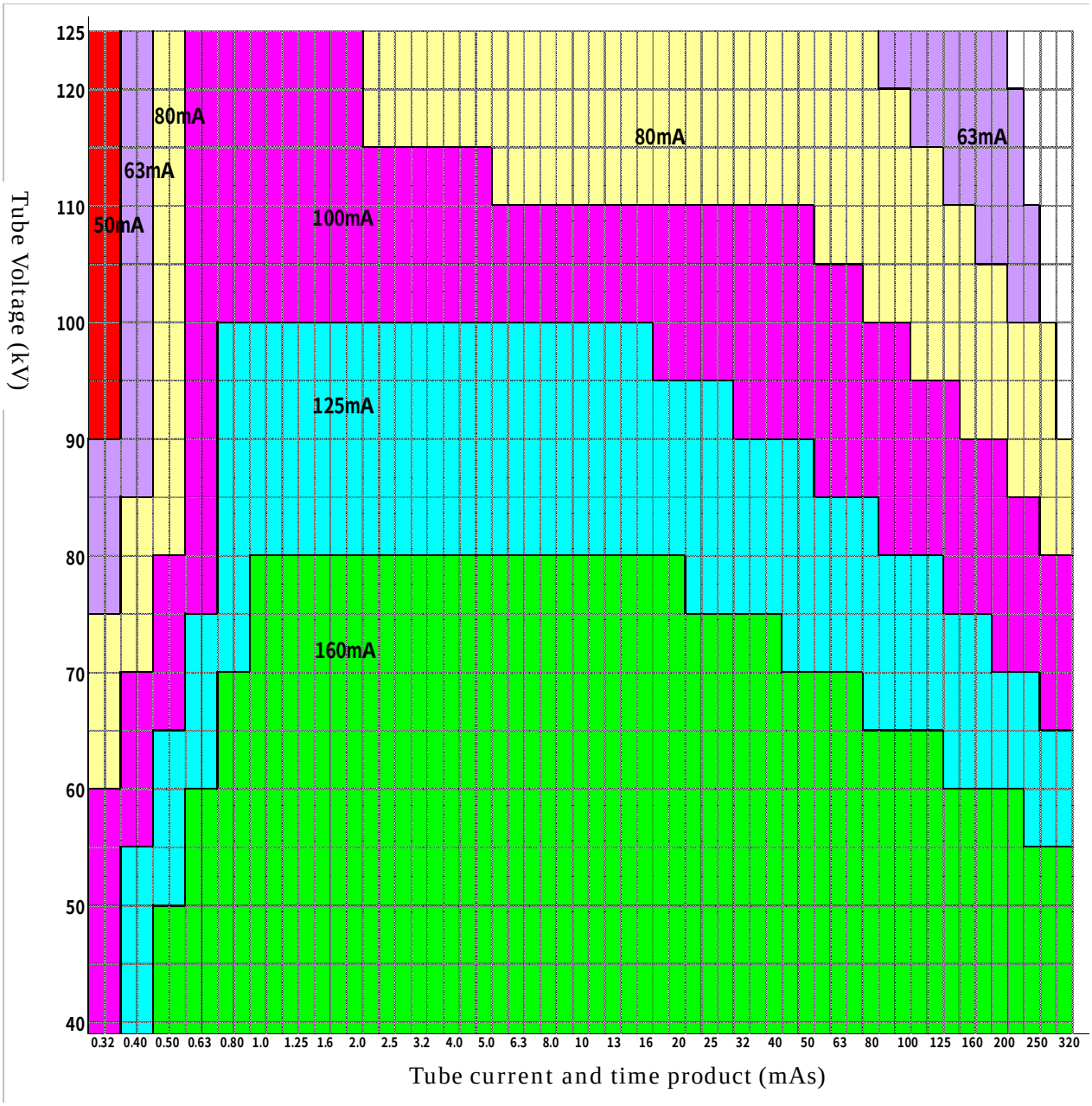


Table Example: Conditions that can be set up at 90kV

At 90kV, a setup of a maximum of 320 mAs is possible.

Since the tube current at 90kV and 100mAs is 100mA, time is 1.0sec.

A setup of 125mA of tube current is possible to take an exposure with 0.8-50mAs.

The time at 90kV and 25mAs is 0.2sec.

MUX-100D/100DJ（at low level battery）

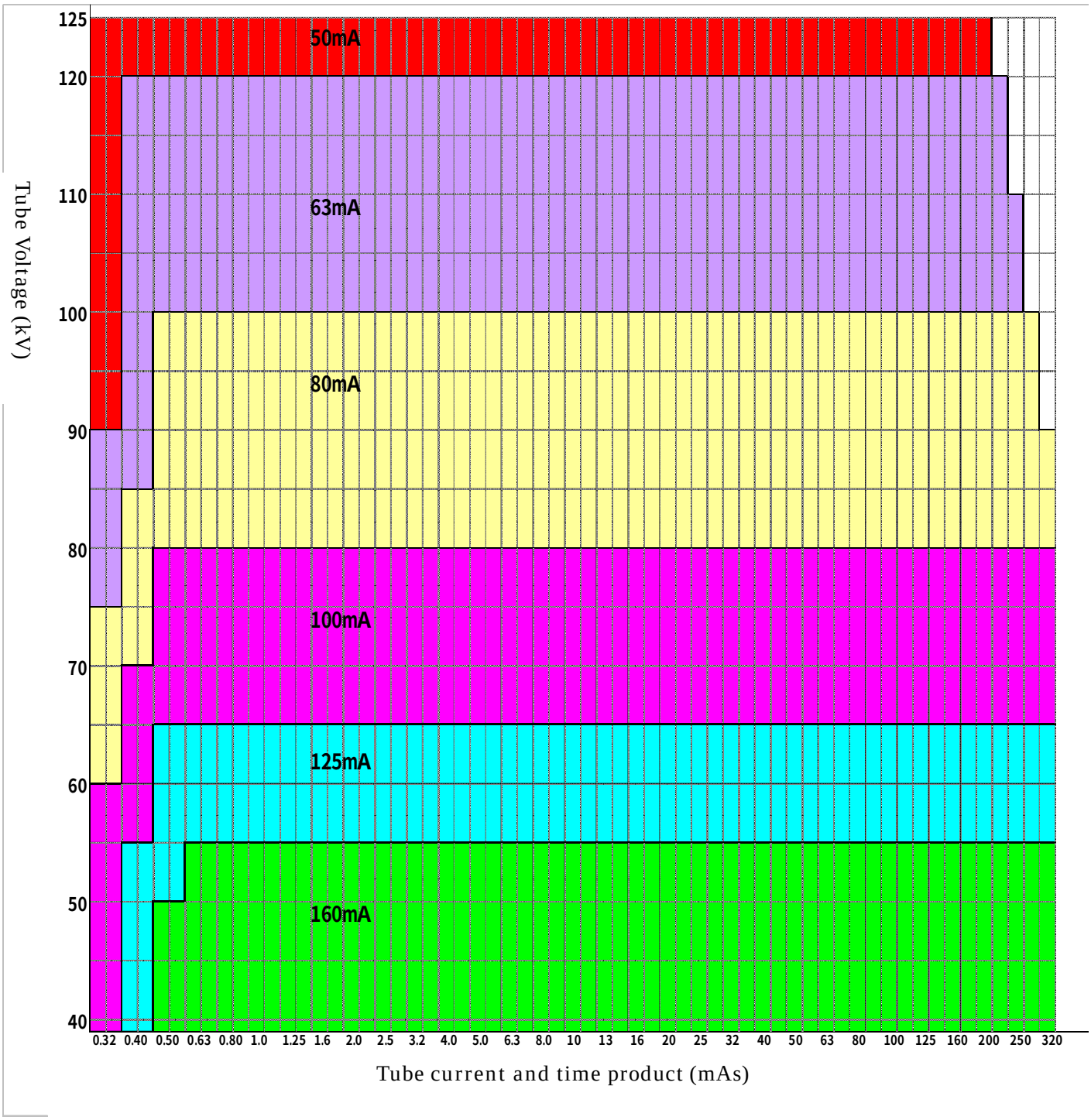
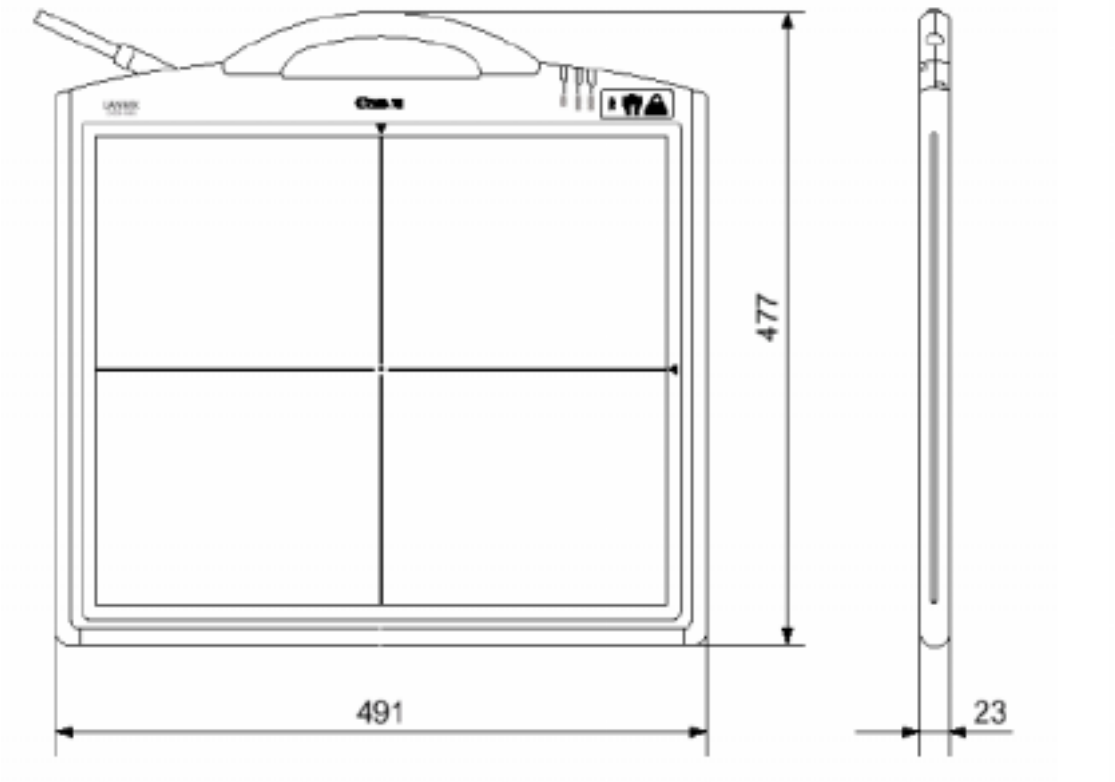


Table Example: Conditions that can be set up at 90kV.
At 90kV, a setup of a maximum of 320 mAs is possible.
Since the tube current at 90kV and 100mAs is 80mA, time is 1.25sec.

When a setup of 125mA of tube current is possible to take an exposure with tube voltage is lowered to 65kV. mAs is 0.5-200mAs.
The time at 65kV and 25mAs is 0.2sec.

9.5 Imaging Unit

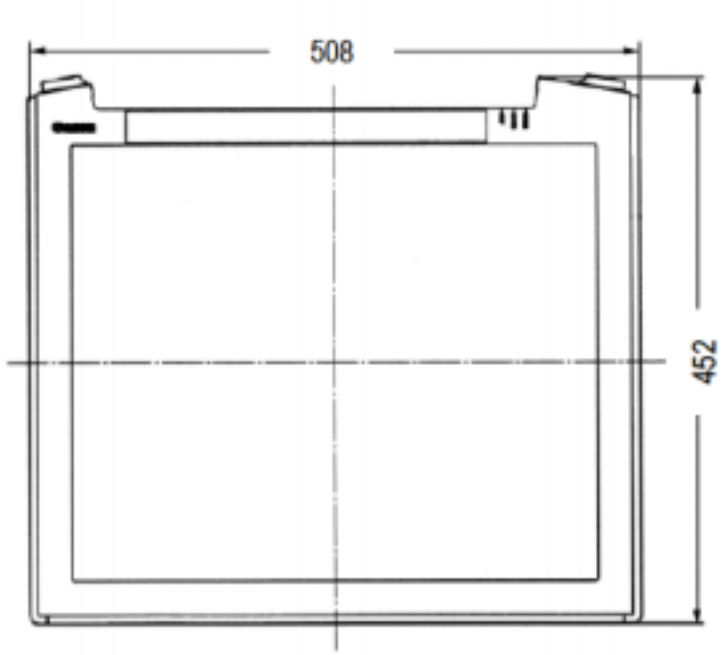


Unit: mm

Mass: 4.8 Kg (except the cable)

5.7 Kg (with 7m cable)

9.6 Grid (Option)



Unit: mm

Mass: 0.9Kg (Frame)

9.7 Anatomical Program Number

The correspondence table of the anatomical code set to the exposure mode key of DR system and the anatomical program number of MUX (APR number) is described as follows.

Please refer to CANON manual for the registration method of the exposure mode key of DR system.

APR number	Filming region	Filming orientation	Body thickness correction	Default kV	Default mAs
1	HEAD	FLONT (AP)	THIN	64	14
2	HEAD	FLONT (AP)	NORMAL	64	14
3	HEAD	FLONT (AP)	OBESE	66	16
4	HEAD	SIDE (LATERAL)	THIN	56	14
5	HEAD	SIDE (LATERAL)	NORMAL	58	14
6	HEAD	SIDE (LATERAL)	OBESE	61	14
7	HEAD	OBLIQUE	THIN	56	18
8	HEAD	OBLIQUE	NORMAL	59	18
9	HEAD	OBLIQUE	OBESE	62	18
10	CHEST	FLONT (AP)	THIN	79	2.8
11	CHEST	FLONT (AP)	NORMAL	79	3.2
12	CHEST	FLONT (AP)	OBESE	82	3.2
13	CHEST	SIDE (LATERAL)	THIN	88	3.2
14	CHEST	SIDE (LATERAL)	NORMAL	91	3.6
15	CHEST	SIDE (LATERAL)	OBESE	95	4
16	CHEST	OBLIQUE	THIN	87	3.2
17	CHEST	OBLIQUE	NORMAL	90	3.2
18	CHEST	OBLIQUE	OBESE	93	3.2
19	ABDOMEN	FLONT (AP)	THIN	74	56
20	ABDOMEN	FLONT (AP)	NORMAL	77	63
21	ABDOMEN	FLONT (AP)	OBESE	80	71
22	ABDOMEN	SIDE (LATERAL)	THIN	86	63
23	ABDOMEN	SIDE (LATERAL)	NORMAL	90	63
24	ABDOMEN	SIDE (LATERAL)	OBESE	95	63
25	ABDOMEN	OBLIQUE	THIN	78	80
26	ABDOMEN	OBLIQUE	NORMAL	83	90
27	ABDOMEN	OBLIQUE	OBESE	89	100
28	WAIST	FLONT (AP)	THIN	68	22
29	WAIST	FLONT (AP)	NORMAL	68	25
30	WAIST	FLONT (AP)	OBESE	71	25
31	WAIST	SIDE (LATERAL)	THIN	82	22
32	WAIST	SIDE (LATERAL)	NORMAL	84	25
33	WAIST	SIDE (LATERAL)	OBESE	86	28
34	WAIST	OBLIQUE	THIN	71	22
35	WAIST	OBLIQUE	NORMAL	74	25
36	WAIST	OBLIQUE	OBESE	76	28

APR number	Filming region	Filming orientation	Body thickness correction	Default kV	Default mAs
37	LEG	FLONT (AP)	THIN	63	7.1
38	LEG	FLONT (AP)	NORMAL	63	8
39	LEG	FLONT (AP)	OBESE	66	8
40	LEG	SIDE (LATERAL)	THIN	65	7.1
41	LEG	SIDE (LATERAL)	NORMAL	68	7.1
42	LEG	SIDE (LATERAL)	OBESE	71	7.1
43	LEG	OBLIQUE	THIN	65	8
44	LEG	OBLIQUE	NORMAL	65	9
45	LEG	OBLIQUE	OBESE	65	10
46	FOOT	FLONT (AP)	THIN	58	2.2
47	FOOT	FLONT (AP)	NORMAL	58	2.2
48	FOOT	FLONT (AP)	OBESE	61	2.5
49	FOOT	SIDE (LATERAL)	THIN	57	2
50	FOOT	SIDE (LATERAL)	NORMAL	58	2
51	FOOT	SIDE (LATERAL)	OBESE	61	2
52	FOOT	OBLIQUE	THIN	55	2.5
53	FOOT	OBLIQUE	NORMAL	58	2.5
54	FOOT	OBLIQUE	OBESE	61	2.8
55	ARM	FLONT (AP)	THIN	58	2.8
56	ARM	FLONT (AP)	NORMAL	58	3.2
57	ARM	FLONT (AP)	OBESE	61	3.2
58	ARM	SIDE (LATERAL)	THIN	61	2.8
59	ARM	SIDE (LATERAL)	NORMAL	63	3.2
60	ARM	SIDE (LATERAL)	OBESE	65	3.6
61	ARM	OBLIQUE	THIN	60	3.2
62	ARM	OBLIQUE	NORMAL	60	3.6
63	ARM	OBLIQUE	OBESE	60	4
64	HAND	FLONT (AP)	THIN	53	0.9
65	HAND	FLONT (AP)	NORMAL	53	1
66	HAND	FLONT (AP)	OBESE	56	1
67	HAND	SIDE (LATERAL)	THIN	56	0.9
68	HAND	SIDE (LATERAL)	NORMAL	58	0.9
69	HAND	SIDE (LATERAL)	OBESE	60	0.9
70	HAND	OBLIQUE	THIN	56	1
71	HAND	OBLIQUE	NORMAL	57	1
72	HAND	OBLIQUE	OBESE	57	1.1

No Text

SHIMADZU CORPORATION

'05.2

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604-8511, Japan.
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